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A journal of stomatology; devoted to the advancement and dissemination of knowledge pertaining to the teeth and mouth, and to their relations to the body as a whole

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GENERAL ANNOUNCEMENTS

Proceedings of Dental Societies to be Published as Independent Journals Within the Journal of Dental Research

Affiliated dental societies now publish their Proceedings on conditions that make each Society's group of papers, in effect, its own independent journal under the covers of the Journal of Dental Research. Sections may be obtained as reprints, for issuance in separate volumes of Transactions. The import of this development, for the cause of independent professional journalism, will become evident in the successive issues. Information regarding the plan will be given to any society that may request it. All communications regarding the contents of the sections should be addressed to the representatives of the respective societies.

Beginning with this volume the papers published by societies will appear in the main body of the text of each number and will not be segregated at the end in a "section of proceedings." The papers that societies contribute to each number will be regularly listed here.

Papers Contributed by Dental Societies to this Number

First District Dental Society of the State of New York

John Oppie McCall, A.B., D.D.S., F.A.A.P., F.A.C.D. Studies of the etiology of approximal and gingival caries 461

Jewell M. Gompertz, D.D.S. Factors that influence mouth conditions during pregnancy 473

New York Academy of Dentistry

Thaddeus P. Hyatt, D.D.S., F.A.C.D. Prophylactic odontotomy. An operative procedure for the prevention of decay 389

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Delay in the Publication of this Number

The long delay in the publication of the numbers of this volume has been explained in a circular letter to the subscribers. The effort to publish the delayed volumes for 1924 and 1925 has been discontinued. The numbers of this volume will be brought up to date by giving them the combined year numerals 1924-26.

Important Books Received

The dentist's own book. By C. Edmund Kells, D.D.S., F.A.C.D., 1237 Maison Blanche, New Orleans. 1925: pp. 510; 7 5/8 x 4 5/8 in.; $7.50. C. V. Mosby Company, St. Louis, Mo.

The life and work of James Leon Williams. By George Wood Clapp, D.D.S., 220 West 42nd Street, New York City. With an introduction by C. N. Johnson, M.A., D.D.S., F.A.C.D., President of the American Dental Association, 1925: pp. 299; 7 1/4 x 3 3/4 in. Dentists' Supply Company, New York City.

MEDICO-DENTAL CASE RECORDS: FIRST REPORT

A Clinico-pathological Study

BISSELL B. PALMER, Jr., D.D.S., and MALCOLM W. CARR, D.D.S.

New York City

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I. Introduction

In a preliminary paper,[1] we emphasized the prevailing tendency to report medico-dental cases without sufficient data to give them scientific value. Believing this to be due principally to inadequate records, there was offered in that paper a complete medico-dental chart for systematic compilation of case histories.

The following case is the first of a series that will be described in this Journal. These case records relate to patients suffering from systemic diseases commonly understood to arise frequently from focal infections. An effort has been made to record every factor that might have a bearing on a conclusion as to whether any improvement in the patient's condition was due to the elimination of the dental foci of infection. The cases for this study have been very carefully selected to eliminate such as are hopelessly complicated by old age or multiple chronic diseases. When a sufficient number have been

[1] Palmer and Carr: *Journal of Dental Research*, 1926, vi, p. 271.

studied, a tabulation of the results may be of some value in determining the extent to which dental focal infections play a rôle in systemic diseases. Each case record will be supplemented by an appendix in which will be found notes on nomenclature and terminology, and also explanations of the significance attached to some of the factors of diagnostic importance.

It is hoped that a careful study of these cases and their supplements will yield the following results:

(1) That interest may be stimulated in the medical aspect of many dental cases.

(2) That interest may be stimulated in the dental aspect of many medical cases.

(3) That the knowledge of the general practitioner of dentistry may be broadened in medical terminology, physical diagnosis, clinical diagnosis by laboratory methods, and the principles of medicine.

(4) That the knowledge of the general practitioner of medicine may be broadened in dental terminology, dental diagnosis, and the principles of dentistry.

II. Case C-1 (1):[2] Endocarditis

General history

On June 2, 1924, an unmarried American woman, 41 years of age, a school teacher, entered the hospital[3] upon the recommendation of her physician, for medical observation and treatment of a cardiac affection. Her chief complaints (2) were shortness of breath upon slight exertion, palpitation of the heart, and swollen and painful joints. Her family history (3) presented no evidence of tuberculosis, malignancy, insanity, or diabetes. Her father had a definite history of cardiovascular disease, and died at the age of 69 of angina pectoris and uremia. Her mother was living and well. The patient was the only child.

As a child, she had both measles and whooping cough. There was no past history (4) of scarlet fever, diphtheria, typhoid fever, rheumatic fever, or venereal disease. She had a moderate anemia at 10 or 11

[2] The numerals in parenthesis refer to the numbered items in the "Notes and comment," on page 296.

[3] The Fifth Avenue Hospital, New York City.

years of age. For the past twenty years she had had frequent attacks of tonsillitis (5). She had influenza during the epidemic six years ago, and a second attack a year ago which was exceedingly severe. For several years she had been having attacks of indigestion with vomiting, and occasionally with syncope. For many years she had suffered from myalgia (6) in the left thorax, left shoulder, and left arm. For several months she had slept poorly. In December, 1923, six months before admission, during an unusually severe attack of tonsillitis, her physician thought the heart was affected. In January, 1924, neuritis with a numb or dead sensation following it affected the left thigh above the knee. From February to April arthritis developed in the right foot and then in the left foot, followed later by an acute attack in the joints of the knees. The joints at this time became swollen and painful, and it was evident that, even though the patient had been under almost continuous treatment by her physician since December, 1923, but little improvement had been made. She had palpitation (7) upon slight exertion and found it difficult to climb many stairs without frequent periods of rest. She often had a sensation of giddiness, and occasionally had attacks of syncope. She was conscious of a sensation of lassitude and malaise (8). She was finding it increasingly more difficult to carry on her routine duties, and fatigue developed easily. In May she had a tonsillectomy performed, following which there was only a moderate improvement in her general condition.

One week before admission to the hospital the patient went into a deep syncope (9) while at home, and remained unconscious for several minutes. Thereafter she had frequent periods of dizziness, and several times lost consciousness. On June 2nd, 1924, when she was admitted to the hospital, she gave no history of precordial pain (10) or nycturia (11). The arthritis from which she had been suffering for the past six months was as severe as it had been at any time previously. In addition, her cardiac affection was manifesting acute symptoms.

Examination showed a well developed and well nourished woman, forty years of age, slightly cyanotic (12) in appearance but not appearing acutely ill. She was neurotic in temperament, occasionally becoming hysterical.

Eyes: Negative except for slight pallor of the conjunctivae.
Teeth: See special report of dental consultant below.
Naso-pharynx: Clear. Tonsils had been removed. Accessory sinuses clear.
Lungs: Negative; clear and resonant throughout.
Heart: See special report of cardiac consultant (page 287).
Abdomen: Negative; no tenderness (13), rigidity (14), nor masses (15).
Liver: Lower border palpable 1 cm. below the costal margin; not sensitive (16).
Spleen: Not palpable (17).
Extremities: Edema absent (18). Joints slightly swollen and tender.

Report of the Dental Consultant

Past dental history (19). "From 1911 to 1915 the patient made regular visits to her dentist, during which time root-canal work was done and fillings were inserted. In 1919, the inferior right first molar was filled over a "dead pulp." One year ago, an attempt to remove the inferior left second molar was unsuccessful."

Oral examination. "Oral examination shows a pathological condition of both periodontal and periapical tissues. There is a slight deposition of salivary calculus. There is a mild generalized gingivitis and a chronic suppurative pericementitis (20), particularly in the region of the lower anterior teeth. The superior right second bicuspid and first molar, and the inferior left second bicuspid and first molar, have gold-shell crowns. There is evidence of gingival irritation from all of these crowns. There are many large fillings and moderate dental caries. The superior left third molar and the inferior left third molar have been removed. The occlusion is fair and the oral hygiene is moderately good."

Roentgenographic examination.

"Chronic proliferative pericementitis (21):
Superior right cuspid.
"Chronic rarefying osteitis; with granuloma (22):
Superior right second bicuspid and first and second molar.
Superior left cuspid and first and second bicuspid.
Inferior right second bicuspid.
Inferior left second bicuspid and first and second molars.
"Chronic rarefying osteitis with suppuration (sinus) (23):
Inferior right first molar."

"All of the teeth showing pathological conditions at the apices are pulpless and the root canals have been partially filled, with the exception of the superior right second bicuspid and the inferior left second molar in which there is no evidence of root-canal fillings. The superior left first and second bicuspids and first molar show a well developed excementosis. There is a moderate degree of alveolar absorption. The oral condition is probably an etiological factor (24) in the patient's general condition."

Recommendations. "Advise the removal of all pulpless teeth, in several stages (25). Procain-Suprarenin solution (1 per cent) is the anesthetic of choice. The first operation should consist of the removal of a simple tooth with an infiltration technic. The advisability of more extensive surgery at successive operations may be determined according to the manner in which the patient reacts (26) to the initial operation. The removal of the teeth indicated may probably be accomplished in five operations. It is desirable that the patient receive some form of digitalis (27) as a prophylactive premedication in order that any possible exacerbation following the removal of the teeth may be attenuated."

Report of the Cardiac Consultant

Cardiological examination. "The heart shows a moderate enlargement (28), chiefly the left ventricle. There is a distinct blowing systolic murmur (29), transmitted to the axilla, and a soft diastolic murmur (30). There is also a reduplicated second sound (31) at the apex, presystolic in time, giving a 'gallop rhythm' (32) which suggests a third heart sound. The pulse rate is slightly increased."

Roentgenographic study. "Stereoscopic films (33) were made of the chest at a distance of six feet and show the exact size, shape, and position of the heart and the aorta. The aorta is apparently normal. The heart shows a definite increase in size chiefly confined to the left heart. This has the appearance of a mitral lesion (34). "The cardiac measurements (35) are as follows: The left border is 9.2 cm. from the midsternum, and the right border is 4.3 cm. to the right of the midsternum."

Electrocardiogram (36). "Normal sinus mechanism (37) with average recorded rate of 100 per minute. The auriculo-ventricular conduction (38) is delayed (incipient heart-block) (39). The conduction time as measured by the P-R interval (40) in Lead II (41) ranges between 0.21 and 0.24+ (normal is less than 0.20). Left ventricular preponderance suggests disproportionate increase in the mass of the left ventricle. Some depression of the T-wave suggests a digitalis effect and therefore the delayed conduc-

tion should not be ascribed to organic damage until similar findings are observed at least two or three weeks after the withdrawal of all digitalis bodies (42). The curves show marked distortion due to somatic tremor (nervous agitation)."

Laboratory and miscellaneous data

While the patient was in the hospital the high and low records of temperature, pulse, and respiration were recorded as follows: Temperature, 97.2–99.4; pulse, 76–100; respiration, 16–22.

Urinalysis (43): Amount, normal; specific gravity, 1.010; reaction, alkaline; albumin, absent; sugar, absent; casts, absent; microscopic examination: Few white blood cells and epithelia.

Blood examination (44): *May 14th* (first entry to the hospital for tonsillectomy)—Hemoglobin, 89 per cent; red blood cells, 4,300,000; white blood cells, 9,600; polymorphonuclear leukocytes, 83 per cent; lymphocytes, 16 per cent; eosinophiles, 1 per cent. *June 3rd* (second entry to hospital)—Hemoglobin, 91 per cent; red blood cells, 5,450,000; white blood cells, 6,300. Differential white blood count was not recorded at this time.

Blood chemistry (45) (mg. per 100 cc.): Urea nitrogen, 11.3; Uric acid, 4.1; Sugar, 102. Wassermann negative.

Blood pressure (46): Systolic, 124 mm.; diastolic, 80 mm.

Diagnosis:

I. Heart
   Etiological: Subacute rheumatic endocarditis (47).
   Anatomical: Mitral insufficiency (48) and stenosis (49). Moderate cardiac hypertrophy (50).
   Functional: Sinus mechanism—no cardiac insufficiency nor cardiac failure.
II. Subacute inflammatory rheumatism.
III. Oral sepsis.

Comment of the cardiologist. "It appears from this history that we are dealing with a typical case of rheumatic heart disease in which the causal infection is two-fold: tonsils and teeth. The infected tonsils have been removed without, however, any great improvement in the patient's general condition."

Treatment and operations

Medical treatment. It was thought advisable to digitalize (51) this patient as a prophylactive measure (52) in order to avoid, if possible, any exacerbation (53) following the removal of the infected teeth. On June 7, digitalization was started in the form of Digitan. One Digitan tablet was given twice a day. This, however, had to be discontinued on June 10, because of the resulting nausea (54). Consequently the patient received no other form of medication during the time of this study excepting sedatives and narcotics.

Oral surgical treatment. All of the oral operations were performed with the patient in bed in a semi-supine posture (55). The local anesthetic employed consisted of a 1 per cent solution of procain containing epinephrin 1–40,000.

First operation, June 9th. Removal of the superior left second bicuspid was performed under procain anesthesia. Two cc. of the solution were employed by a supra-periosteal infiltration. The patient complained of dizziness and palpitation immediately following the injection, and went into a light syncope from which she rapidly recovered. The pathological condition at the apex was found to be a chronic rarefying osteitis with granuloma formation. The socket was curetted and dressed with iodoform gauze. The cardiac exacerbation following the operation was less severe than had been anticipated. The dizziness continued, and the palpitation was slightly increased. The nervous reaction, however, was more severe; at times the patient was hysterical and developed symptoms of amnesia (56) for short periods which was a source of great apprehension to the patient. There was no important alteration in the pulse, respiration, or temperature. The cardiac exacerbation and the nervous reaction developed within the first twelve hours following the operation, and subsided in twenty-four hours (57).

Second operation, June 11th. Removal of the superior left cuspid and first bicuspid was performed under procain anesthesia. Two and one-half cc. of the solution were employed by a supra-periosteal infiltration. The reaction to the injection was less severe than that two days previously. There was some dizziness after the injection. The palpitation was less and syncope did not develop. The patho-

logical condition at the apices of both of these teeth was found to be a chronic rarefying osteitis with the formation of granulomata. Culture was taken and showed streptococcus viridens and pus cells with staphylococci predominating. An autogenous vaccine (58) was prepared but was not administered. The sockets were curetted and given the usual post-operative treatment. The exacerbation following the operation was less severe (59) than that after the first operation. The patient complained chiefly of dizziness, weakness, and amnesia. There were no definite symptoms relating to the heart or joints. The temperature, pulse, and respiration remained within the normal limits.

Third operation, June 14th. Removal of the superior right cuspid, first and second bicuspids, and first molar was performed under procain anesthesia. Six cc. of the solution were employed by supraperiosteal infiltration. There was no unfavorable reaction to the injection. The teeth were removed with considerable difficulty, due to the excementosis and the heavy buccal plate of bone. The sockets were curetted and the usual post-operative care was given to the wounds. The pathological condition at the apices of these teeth was found to be a chronic rarefying osteitis with granulomata. The exacerbation following the removal of these teeth was much milder.

Fourth operation, June 21st. Removal of the inferior right second bicuspid and first molar was performed under conduction anesthesia; 2.5 cc. of the procain solution were used. There was no unfavorable reaction to the injection. The pathological condition at the apex of the bicuspid was found to be a chronic rarefying osteitis with a granuloma. The molar showed a marked rarefying osteitis with suppuration through a sinus. The areas of infection were curetted and given the usual post-operative care. There was no exacerbation following this operation.

Fifth operation, June 27th. Removal of the inferior left second bicuspid and first and second molars was performed under conduction anesthesia. Two and one-half cc. of the procain solution were employed. There was no unfavorable reaction to the injection. The pathological condition was found to be a chronic rarefying osteitis with granulomata. The sockets were curetted and the post-operative dressings were instituted as usual. There was no exacerbation following this operation.

The patient remained in the hospital until July 1st, when she was discharged, "improved" with a favorable prognosis.

First follow-up examination

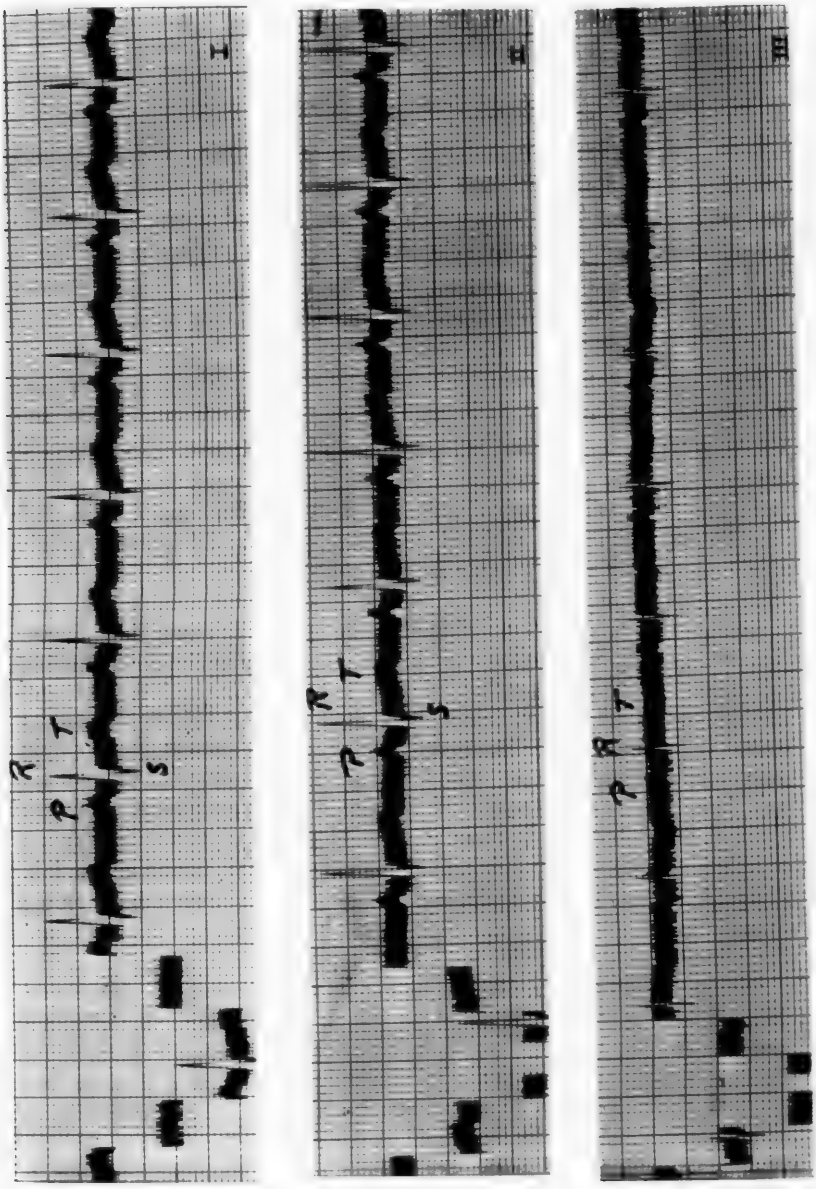
The first follow-up examination was made during the third and fourth weeks after discharge from the hospital, and is dated July 30th, 1924. The symptoms which the patient had at the time of this examination may be summarized as follows: moderate dyspnoea (60), fatigue, and giddiness; slight though not frequent palpitation; moderate to severe rheumatic pains, although somewhat better following the removal of the teeth.

Eyes, negative; naso-pharynx, clear; lungs, negative; bases, clear; abdomen, negative; liver—lower border palpable 1 cm. below the costal margin, not sensitive; spleen, negative: extremities, edema absent.

Blood examination, July 30, 1924. Hemoglobin, 83 per cent; red blood cells, 4,000,000; white blood cells, 8,200. Differential white blood count was not recorded at this time.

Cardiological examination. "There are no sensory or motor disturbances (61) in the chest wall related to the heart. There are no thrills (62) and no pulsations in the sternal notch (63). The left border in the fifth interspace is 9 cm. to the left of the median line. At the apex the rhythm is regular (64). The first sound (65) is of poor quality and not as loud as the second sound (66) in the same area. The first sound is followed by a long, blowing systolic murmur, audible to the left as far as the mid-axillary line. At the base, P_2 is louder than A_2 and P_2 (67) is accentuated +++ (68). A systolic murmur, slightly rough, is audible at the base, louder on the left. The pulses (69) are synchronous, soft, compressible, somewhat larger on the right (arterial anomaly); rate 84; Blood pressure: systolic, 110 mm.; diastolic, 64 mm."

Roentgenographic study. "The aortic area appears normal. The heart shows the typical mitral contour in the frontal position, consisting of prominence of the left auricular area and a shortening of the left border. In the oblique position, there is a moderate protrusion posteriorly of the left auricle in the retrocardiac space. There is also some increase in the depth of the left ventricle. The total area of the heart is 119 cm.^{2} Although this is not considerable, there is very probably a moderate degree of enlargement present."



Electrocardiograms: Leads I, II, and III (41)

Electrocardiogram. "Normal sinus mechanism with average recorded rate of 80 per minute. The general conformation and time relationship of the curves are normal. There are no evidences of delayed conduction. Inversion of the T-wave in Lead III is not abnormal."

Summary.

"*Diagnosis*"

"*Etiological*"

"Rheumatic cardiopathy, due to foci that have been present in the mouth and upper respiratory tract."

"*Anatomical*"

"Mitral disease: at present there is direct evidence of mitral insufficiency only (no diastolic murmur elicited by exercise).

"Moderate cardiac enlargement including left auricular enlargement and diffuse myocardial changes of rheumatic type. The lesions have probably now healed. Enlargement is only moderate and appears to affect both ventricles."

"*Functional*"

"Normal sinus mechanism with moderate reduction of the cardiac reserve force but without evidences of congestive heart failure. The patient may be placed in Class IIb of the Classification of the Heart Association, as able to carry on greatly reduced activity."

Comment. "The relief from rheumatic pain following tonsillectomy and the removal of dental foci, and the improvement in exercise tolerance within the past few weeks indicates that the patient may probably be placed in Class IIa, or even Class I after a further period of rest.

"At this examination there is no evidence of the third heart sound which was noted in her physical examination of June 3rd as a reduplicated second sound, and the diastolic murmur has now disappeared. The removal of the infected teeth probably removed the other 70 per cent of her infection. Of course, the valvular lesion will remain; but now that the heart has had a chance to heal completely all that we ought to find is a healed process. Probably there was enough healthy muscle left to carry on very adequately."

Second follow-up examination

The second follow-up examination was made one year and six months after the patient's discharge from the hospital, and is dated December 12, 1925.

Blood examination: Hemoglobin, 100 per cent; red blood cells,

4,630,000; white blood cells, 7,300; polymorphonuclear leukocytes, 68 per cent; lymphocytes, 26 per cent; transitionals, 6 per cent.

Cardiological examination. "There are no essential differences in the findings at this time as compared with those in July, 1924. The rhythm is regular. At the apex a blowing systolic murmur is audible at rest and can be followed into the left axilla. At the base, P_2 is louder than A_2, and P_2 is accentuated ++. These findings are characteristic of mitral insufficiency. After exercise, no true pre-systolic murmur was heard at the apex. During the first minute after exercise a short diastolic whiff was heard at the apex, but it is doubtful whether or not this indicates any organic lesion. At present the evidence is not sufficient to establish a diagnosis of mitral stenosis. The pulses are regular, synchronous, soft and compressible; rate 78; blood pressure: systolic, 128 mm.; diastolic, 68 mm. Alternation (70) of the pulse is not present."

"On *general examination* the only items of interest are the following: Dental foci of infection at the first examination have now been removed. There is slight tenderness over the gall bladder on deep percussion, but this is not sufficient to be conclusive. It suggests another possible focus of infection that should be watched in the future. There are no evidences of congestive heart failure (71) in the lungs, liver, abdomen, or extremities."

Roentgenographic study. "The findings are practically the same as reported in July, 1924. The heart shows a moderate "mitral type" of contour. The dimensions observed are practically the same as in July, 1924:

	July, 1924	*December, 1925*
Median right diameter	4.3 cm.	4.6 cm.
Median left diameter	9.4 cm.	9.1 cm.
Transverse diameter	13.7 cm.	13.7 cm.
Long diameter	15.1 cm.	14.8 cm.
Angle	40°	41°
Area	119 cm.^{2}	121 cm.^{2}

"These dimensions show that the heart has not changed in size. As the general condition has improved distinctly, it indicates that dilatation of the heart was not a factor in the patient's condition in July 1924."

Electrocardiogram. "Normal sinus mechanism with average recorded rate of 80 per minute. The curves are normal and show no essential change from those secured in July, 1924." (See page 292.)

Summary. "The diagnosis remains unchanged: rheumatic cardiopathy with mitral insufficiency, moderate cardiac enlargement, normal sinus

mechanism, and no evidences of congestive heart failure. This examination records the patient's condition one year and six months after removal of infected teeth; and one year and seven months after removal of the tonsils. The changes in the patient's condition occurring between July, 1924, and December, 1925, may be noted as follows:

I. "In 1924 the patient was placed in Class IIb of the Classification of the Heart Association as able to carry on greatly reduced activity. She may now be placed in Class I as able to carry on ordinary physical activity.

II. "The rheumatic pains were somewhat relieved after removal of the tonsils, but complete relief did not appear until the removal of the teeth was completed. No rheumatic pains have appeared in the last year and a half.

III. "The patient now sleeps normally, whereas the sleep was very poor in 1924. It is probable that the improvement in the circulation is the cause of greater comfort at night, now permitting sound sleep.

IV. "There are no evidences of progressive disease of the heart: there are no changes in heart size, and no changes in the electrocardiogram. These findings justify the conclusion that the case now presents a healed carditis with enough healthy remaining muscle to carry on the circulation very adequately."

General comment

"The improvement in this case is practically all subjective (72) and not objective (73). The data secured are valuable because they assure us that there is no progressive disease; but the patient's own statements as to absence of pain, ability to work and climb stairs, better sleep, absence of breathlessness and dizziness, and general improvement in health indicate a real improvement."

III. General summary

There are a few outstanding factors in this case which seem of sufficient importance to justify emphasis.

1. The cardiac and joint symptoms were constant for six months prior to the first admission to the hospital.

2. During that period the usual prophylactic and therapeutical measures were instituted, but the patient steadily became worse.

3. At the time of the admission to the hospital the cardiac condition had become sufficiently acute to incapacitate the patient.

4. Following the removal of the infected tonsils there was a slight improvement in the general condition.

5. Following the removal of the infected teeth the patient improved slowly but steadily.

6. Four weeks after removal of the teeth the patient was placed in Class IIb of the Classification of the Heart Association as able to carry on greatly reduced activity.

7. Eighteen months after discharge from the hospital the cardiologist reported the cardiac lesions healed and the patient was placed in Class I of the Classification of The Heart Association as being able to carry on ordinary physical activity; and there were no joint or muscle pains.

8. Relief of the symptoms cannot be attributed to any therapeutic measures.

9. The outstanding lesson to be taken from this case is that we cannot look for complete or permanent relief of symptoms of systemic disease by removing one focus of infection in a case presenting several foci.

We wish to express our appreciation of the cordial coöperation which we have received from the cardiologist, Dr. Milton J. Raisbeck.

667 Madison Avenue.

IV. Notes and comment

Explanatory and supplementary

(1) Case C-1. As these cases are reported they will be classified according to the diseases of the various organs. Thus the symbol C represents the *cardiac* group.

(2) Chief complaint. It is the expression by the patient of the symptoms which cause the greatest distress, which immediately draw attention to the site of disease, and which indicate the line of investigation to be followed.

(3) Family history. Important in its relation to predisposition to disease.

(4) Past history. Inquiry into the past medical history is made for the purpose of ascertaining the patient's previous diseases, which may have a bearing upon the present illness. This is particularly important in the relation of scarlet fever, diphtheria, small pox, typhoid fever, rheumatic fever, and syphilis, to organic diseases.

(5) Tonsillitis. Recurrent attacks of tonsillitis may have a definite relation to the development of rheumatic affections.

(6) Myalgia. Muscular pain.

(7) Palpitation. Conscious forceful pulsation of the heart, which may be a symptom of valvular heart disease.

(8) Lassitude and malaise. These are symptoms which may accompany a low grade toxemia and lowered resistance.

(9) Syncope (fainting). A sudden fall in blood pressure or failure of cardiac systole, resulting in cerebral anemia and more or less loss of consciousness.

(10) Precordial pain. A radiating pain in the region over the heart. Severe pain in this region is the outstanding feature of angina pectoris and also of some of the advanced valvular diseases.

(11) Nycturia. A condition in which the secretion of urine is active at night. A symptom of advanced cardiovascular renal disease.

(12) Cyanosis. A dark bluish or purplish coloration of the skin and mucous membrane due to deficient oxygenation of the blood. The principal extra-pulmonary cause of cyanosis is to be found in advanced heart disease, particularly when associated with loss of vasomotor tone.

(13) Abdominal tenderness. When tenderness is elicited upon palpation of the surface of the abdomen, it indicates the possibility of a diseased abdominal organ. The tenderness is most apt to be encountered over the gall bladder, stomach, spleen, kidney, appendix and sigmoid flexure. In acute peritonitis there is general or diffuse tenderness.

(14) Abdominal rigidity. Rigidity of the abdominal wall with possibly spasm upon attempts at palpation, indicates inflammation of the peritoneum or of an abdominal organ. Rigidity of the right rectus muscle alone occurs with acute appendicitis, whereas bilateral rigidity of the recti muscles accompanies acute peritonitis.

(15) Abdominal masses. During palpation of the abdomen the existence of new growths may be determined.

(16) Liver not sensitive. The liver becomes sensitive when it is diseased. Sensibility of the liver is manifested by pain upon pressure. In the normal adult subject the inferior border of the liver will not be encountered below the costal margin.

(17) Spleen not palpable. The spleen is not palpable in the normal adult with the normal spleen occupying its normal position beneath the left vault of the diaphragm.

(18) Edema of extremities. Edema is an abnormal accumulation of clear watery fluid in the lymph spaces of the tissues. Edema of the legs, without any of the neck or face, is due primarily to heart failure, secondary to valvular disease, myocardial affections, renal or arterial affections.

(19) Past dental history. This part of the history is of prognostic importance as it indicates the length of time the infected teeth have been present.

(20) Chronic suppurative pericementitis (periodontoclasia). A disease process which tends to produce a breaking down of the tissues around the teeth.

(21) Chronic proliferative pericementitis. This is the first change occurring in an infected apical peridental membrane. This condition is characterized by a thickening of this tissue. The invading organism is usually of low virulence of the non-hemolytic type. The inflammatory reaction is chronic, slowly progressive and proliferative in nature, giving rise to little apparent disturbance.

(22) Chronic rarefying osteitis (granulomatous). This is the condition resulting from the thickening of the peridental membrane, which takes place at the expense of the bone of the alveolar process. As proliferation of round cells occurs, the bone becomes rarefied and finally destroyed, leaving a space filled with chronic inflammatory granulation tissue, the granuloma.

(23) Chronic rarefying osteitis (suppurative). A condition characterized by the breaking down of the previously formed granulation tissue with the formation of pus, which may discharge through a sinus (chronic abscess). In some cases there may be both pus and granulation tissue; this is the suppurating granuloma.

(24) Etiological factor. Following the physical examination and a complete study of the history of the case, an estimation is made as to whether the oral condition of the patient is probably an etiological factor, or an aggravating factor, or not a factor in the patient's general condition.

(25) Stage operation. In order to avoid the sudden augmentation of the general absorption of toxins, which may result from the removal of too many infected teeth at one time, it is advisable to perform the removal of the teeth in stages.

(26) Reaction to operation. A post-operative exaggeration of previously existing symptoms, or any demonstrated tendency of the patient to suffer operative shock or depression, would indicate a necessity for conservatism in procedure.

(27) Digitalis. A drug used as a cardiac stimulant. It stimulates and strengthens the muscle fibers of the heart, thereby increasing pulse force and arterial tension. It tends to slow the pulse and regulate the rhythm.

(28) Cardiac enlargement. Overgrowth of the musculature of the heart is the result of overwork and inflammatory injury. Conditions in which the blood pressure is abnormally high (arteriosclerosis, and chronic nephritis)

are followed by cardiac enlargement, chiefly of the left ventricle. Lesions which throw an extra burden upon the right ventricle (mitral stenosis, congenital lesions) produce right ventricular hypertrophy. An obstructive lesion between the left auricle and the left ventricle (mitral stenosis) produces an enlargement of the left auricle.

(29) Systolic murmur. A murmur occurring during contraction of the ventricles (systole). A systolic murmur heard at the apex and in the left axilla is present in mitral insufficiency.

(30) Diastolic murmur. A murmur which occurs during the period of relaxation of the ventricles. A diastolic murmur at the apex of the heart is heard in mitral stenosis.

(31) Reduplicated second sound. This phenomenon is caused by the failure of the aortic and pulmonary valves to close simultaneously as a result of disturbance of the normal ratio between the pressures in the greater and lesser circulations. This circulatory imbalance results from a rise in the pulmonary blood pressure, which is commonly due to lesions of the mitral valve.

(32) Presystolic gallop rhythm. It is characterized by the occurrence of a sound, sometimes termed a third sound, which is audible just prior to the first sound of the heart, especially in association with mitral stenosis.

(33) Stereoscopic film. Two films of the same object taken from slightly different view-points. When these films are examined through the stereoscope they blend into one, giving an appearance of solidity.

(34) Mitral lesions. May be either mitral stenosis (a narrowing of the orifice) or mitral insufficiency, a condition in which there is a failure of the valve to completely close.

(35) Cardiac measurements. There is considerable variation in the size of the heart and marked discrepancies exist in the observations that have been recorded. However, the average adult heart is from about 12 to 15 cm. (4 3/4 – 6 inches) long, and from about 9 to 11 cm. (3 1/2 – 4 1/2 inches) wide.

(36) Electrocardiogram. A record of the electrical changes that take place in the heart muscle during the cycle of contraction.

(37) Sinus mechanism. Normal cardiac mechanism, in which the normal pace-maker or sinus node rhythmically originates the heart beat.

(38) Auriculo-ventricular conduction time. This is the time that elapses from the beginning of auricular activity to the beginning of ventricular activity. It is the length of time taken for the conduction of the activating impulse from the sinus node in the right auricle to the ventricular muscle.

(39) Heart block. A disturbance of conduction of the excitation wave

in its passage from the auricle to the ventricles. It may be of various degrees: simple delay in conduction (incipent heart block), or more or less complete failure of conduction.

(40) P-R interval. The space on the electrocardiogram (from the beginning of the P-wave to the beginning of the R-wave) which indicates the length of time between the liberation of the excitation wave by the sinus node and its arrival in the ventricle (conduction time). The time is measured on curves by means of vertical lines which are traced at intervals of 0.04 (or 1/25) seconds. Normally the P-R interval does not exceed five small divisions or 0.20 (or 1/5) second. P, therefore, represents the beginning of auricular activity, while Q-R-S-T are produced by activity of the ventricle. P = Systole of auricles; P-R = Conduction time; R-T = Systole of ventricles; T-R = Diastole of ventricles; T-P = Diastole of entire heart.

(41) Leads—I, II, and III. *Lead I*—The record secured when the right and left arms are connected with the electrocardiograph. *Lead II*—The record secured when the right arm and left leg are connected with the electrocardiograph. *Lead III*—The record secured when the left arm and left leg are connected with the electrocardiograph.

(42) Digitalis bodies. Drugs of the digitalis group. (Digitalis, strophanthus, squills.)

(43) The urinalysis presented is practically a normal one as a few leukocytes and a few cells from the epithelium of various parts of the urinary tract may occur in normal urine.

(44) Blood counts. Blood normally contains the following cellular elements: Red blood cells—5,000,000 per $cm.^3$; white blood cells—7,500 per $cm.^3$ The leukocytes are differentiated mainly into (1) Polymorphonuclear neutrophilic leukocytes, 60–70 per cent; (2) lymphocytes, 25–33 per cent; endotheliocytes, eosinophilic leukocytes, and basophilic leukocytes are present in small numbers in normal blood. All inflammatory and suppurative processes cause a degree of leukocytosis, dependent upon two factors: the severity of the infection and the resistance of the individual.

(45) Blood chemistry. Blood normally contains certain chemical constituents which are of diagnostic importance in problems of metabolism and excretion. The waste products, urea, uric acid, and creatinin are of chief importance, from the clinical point of view. The amounts present in the blood in health are as follows (mg. per 100 cc.): Total non-protein nitrogen, 25–30; urea nitrogen, 12–15; uric acid, 2–3; creatinin, 1–2. Higher figures are usually referable to accumulation of the respective substances in the blood because of defective elimination. In health, each 100 cc. of

blood contains about 100 mg. of sugar, chiefly glucose. In diabetes the blood sugar is increased.

(46) Blood pressure. The force exerted by the blood upon the vessel walls. This pressure is measured in millimeters of mercury in a standard column. Systolic pressure is the pressure of the blood during ventricular contraction. Diastolic pressure is the pressure of the blood during ventricular relaxation. The difference between the systolic and diastolic pressure is termed the pulse pressure. In the normal adult systolic blood pressure is broadly determined by adding 100 to the patient's age and expressing it in millimeters. It has been observed that 40 mm. is the average normal difference between systolic and diastolic blood pressures.

(47) Subacute rheumatic endocarditis. A moderately severe inflammation of the endocardium or lining membrane of the heart due to a low-grade infection.

(48) Mitral insufficiency. Incomplete closure of the mitral valve, occurring as a result of organic deformity of the valve segments, whereby the border of the cusps cannot be brought into close coaptation during ventricular systole. The blood is therefore permitted by an incompetent valve to regurgitate into the left auricle, and a systolic murmur becomes audible upon auscultation.

(49) Mitral stenosis. A narrowing of the mitral orifice, which prevents the free flow of blood from the left auricle to the left ventricle, causing a vibration or murmur, especially when the left auricle contracts just before ventricular systole (pre-systolic murmur) and forces the blood through the narrowed valve.

(50) Cardiac hypertrophy. See cardiac enlargement (28).

(51) Digitalization. The administration of digitalis up to the production of some definite effect.

(52) Prophylactive medication. The administration of drugs as a preventive measure.

(53) Exacerbation. An increase in the severity of a disease or its symptoms.

(54) Nausea. Digitalis sometimes causes nausea and indigestion by irritating the stomach.

(55) Semi-supine. Half-way between the sitting down and the lying down positions. This position aids in preventing cerebral anemia and a resultant syncope.

(56) Amnesia. Loss of memory; specifically amnesic aphasia, the inability to recall the name of an object or a certain word wanted to express an idea.

(57) Time of development of exacerbation. Exacerbations usually occur from twelve to twenty-four hours after operation.

(58) Autogenous vaccine. A vaccine made from a culture of bacteria obtained from the infected area of the patient.

(59) Severity of exacerbation. It is believed that the auto-inoculation incidental to each operation makes less severe the reaction to each subsequent operation.

(60) Dyspnoea. Difficult or labored breathing. A symptom of cardiovascular disease.

(61) Sensory or motor disturbances. Changes in sensation (hyperesthesia) in the chest wall and contracture of the muscles in this region; seen in some forms of heart disease.

(62) Thrills. A vibratory sensation perceived by palpating the chest wall, similar to the vibration felt on stroking a purring cat. A thrill is produced when the blood is forced through a narrowed valve.

(63) Pulsation in the sternal notch. When the aorta is dilated or enlarged, pulsations can be felt by placing the finger deep in the notch at the upper end of the sternum.

(64) Regular rhythm. When the heart beats occur in regular sequence (See sinus mechanism, 37).

(65) First heart sound. Indicates the beginning of ventricular contraction (systole). It is usually considered to be the result of two factors: vibration of the auriculo-ventricular valves and contraction of the ventricular muscle.

(66) Second heart sound. Indicates the beginning of ventricular relaxation (diastole). It is produced by the sudden coaptation of the segments of the semi-lunar valves, which guard the orifices of the aorta and the pulmonary artery.

(67) Accentuation of P_2. The symbol P_2 represents that portion of the second heart sound which is due to the sudden coaptation of the valves that guard the orifice of the pulmonary artery. This sound is best heard at the base of the heart in the second left interspace. The symbol A_2 represents that portion of the second heart sound which is due to the sudden coaptation of the valves that guard the orifice of the aorta. This sound is best heard at the base of the heart in the second right interspace. Regurgitant and stenotic lesions of the mitral valve result in accentuation of the pulmonary sound (P_2).

(68) +, ++, +++, ++++ (one plus, two plus, etc.) indicate degree or severity: + = mild; ++ = moderate; +++ = marked; ++++ = extremely marked or severe.

(69) Pulses. In the normal subject there is no appreciable difference in time in the radial pulse as recorded at the two wrists. The wall of the normal radial artery is soft, yielding and compressible; any departure from the normal elastic state of this artery is of diagnostic importance. In the aged, and in the younger subject having arteriosclerosis, the arterial wall presents varying degrees of resistance to manual compression.

(70) Alternation of the pulse. A condition in which the heart beats are regular in time but vary in amplitude or strength, so that strong and weak beats alternate. This indicates serious exhaustion of the heart muscle and is seen in the advanced stages of arteriosclerosis, chronic nephritis, and myocardial disease.

(71) Congestive heart failure. This is manifested by a chronic passive congestion in the lungs, liver, kidneys, spleen, and extremities. This is due to partial stagnation of blood in the capillaries and venules in consequence of insufficient heart strength.

(72) Subjective symptoms. Those apparent only to the patient.

(73) Objective symptoms. Those evident to the observer or brought out by the physical examination of the patient.

DENTAL LITERATURE: ITS ORIGIN AND DEVELOPMENT

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I. INTRODUCTION

"Nature is so varied in her manifestations and phenomena, and the difficulty of elucidating their causes is so great, that many must unite their knowledge and efforts in order to comprehend and force her to reveal her laws."—Laplace.

Every important science must be correlated to another. In tracing the evolution of any speciality it becomes necessary to start at its origin, with the basic principle upon which it was founded; and at the same time to mention some of the men, and their works, who have contributed to its development. The history of dental literature is largely that of medicine, science, and philosophy, as the growth and evolution of peoples has been more or less in parallel lines with art and science, neither having been created suddenly, but the result of slow progress. Medicine is the foster parent of dentistry. The history of medicine and of dentistry, as a so-called pure science, are so inextricably interwoven that the consideration of one involves the other. Indeed, the physician forms the only bond of continuity in dental history between Greece and Rome, and the middle of the 18th century.

The earliest references to odontology are to be found in Chinese literature. Their literature consists of a large number of books, none of which are of scientific value. In a work believed to have been written by the Emperor Hoang-Ti, founder of Chinese medicine, and who is supposed to have lived 2637 B.C., two chapters are devoted to diseases of the mouth.

Our knowledge of the medicine and of the dental art of the Egyptians was derived largely from various papyri. Of these the chief are:

1. The Papyrus Ebers, preserved at Leipzig, was discovered by Professor Ebers of Egypt in 1872. It dates from c. 1500 B.C., and consists of 110 pages. Chapter 33 considers the treatment of diseases of the teeth (1).

2. The Berlin Medical Papyrus, published by Dr. Brugsch. It dates from c. 1300 B.C., and contains 21 pages (2). In the Berlin Museum, there is also a smaller one of 15 pages.

3. The Kahun Papyrus, published by F. L. Griffith. It dates from c. 2000 B.C., but is a short papyrus, consisting of only 3 pages (3).

4. The Hearst Medical Papyrus, preserved in the University of California, and published by Dr. George A. Reisner. It consists of 17 pages (4).

5. The New York Historical Society, Edwin Smith Papyrus (5). In all, the known material for the medical history of Ancient Egypt consists of less than 185 pages.

On the stone pillar of the Code of Hammurabi, sculptured about 2000 B.C., we also find two paragraphs referring to dental disorders.

II. INVENTION OF PRINTING

Prior to the time when the art of printing came into general use (c. 1440), the methods in vogue for preserving and diffusing the world's accumulated knowledge were by means of hieroglyphics, or in writing. Because of the labor and expense, only matters of great importance were recorded. Matters of lesser importance were transmitted and preserved by word of mouth; and necessarily, on this account, real progress was slow, for much that was learned was easily forgotten.

Undoubtedly the greatest invention that human mind has devised, one that has been of greatest benefit, and has had the most far-reaching effect on the advance of civilization, was the discovery of the art of printing. As the historian Falkenstein (6), has so beautifully expressed it: the art of printing is "to our eyes a third eye, which enables us to look into the greatest distance, to our ears another ear, which permits us to hear prophecies of the past, the voice of the present, and the whispering of the future, and has given us mouth to speak, regardless of distance over land and sea." The earliest printed books are known as "incunabula", a Latin neuter plural signifying "cradle", and used in the sense of the beginning of things; and, by convention amongst bibliographers, very generally limited to cover the period of printing with movable type up to and including

the year 1500. The incunabulas, on account of their rarity, are considered by bibliographers in a class by themselves.

It is impossible to write a history of dentistry without taking into consideration what the issue of the early presses have preserved for us, and what otherwise would have been irreparably lost. Dentistry, as far as we are aware, does not possess books that were published during the period of the "incunabula." However, the invention of printing served to stimulate a literature that gave truth to what we may call early medicine. "The largest place in the medical literature of the period was occupied by the Greek, Latin, and Arabian writers, whose works were later not only printed, but also edited with commentaries and annotations" (7). This early medical literature is not only important for the history of medicine, but represents also a very essential contribution to dentistry and orthodontia. The many achievements of recent years are a source of pride and satisfaction to all dentists, but few could estimate them correctly and keep their true bearings for future progress. We must study the past and appreciate that these developments in dentistry, as in all sciences, have been made possible only by the long, weary toil of those who have gone before, and who carefully gathered crumbs of knowledge and preserved them for the use of future generations. The results of today are but the culmination of untiring efforts of the past, the benefits of which we now reap.

The ancient writings on dental art contain so many conflicting statements relative to its source, that it is difficult to reach an unbiased decision regarding their origin. "Plagiarism was of common occurrence among the early scribes; it was, however, not looked upon as a breach of literary etiquette in the same sense of the word as we interpret this term today." Prinz states (8), that Pliny, in his famous "Naturalis Historia," prides himself on the fact that he is able to present excerpts of nearly one hundred writers and their two thousand works. According to Weber (9) we find that prior to 1800, one thousand, one hundred and eighty six dental treatises had been published: two in the fifteenth century or rather 1490, fifty-one in the sixteenth century, two hundred and sixty-one in the seventeenth, and eight hundred and seventy-two in the eighteenth.

III. THE EARLIEST DENTAL LITERATURE

I have already stated that dentistry, from our present knowledge, does not possess books published during the period of the "incunabula" nor can I find a reference in Ploucquet (10) nor in any of the thirty medical bibliographies at my disposal, of the publication of a strictly dental book before 1500. I have examined all of the bibliographies of medical and general incunabula without a clue to dental material. The only reference that we have that there were works published before 1500 and 1509 is Weber's Bibliographiae (11), and his statement in the *Dental Cosmos* (12): "The works mentioned therein dating from the first dental "Zene Artzney, Nuremberg ac. 1509".

I feel absolutely safe in saying, therefore, that the beginning of *independent* dental literature does not date earlier than 1514, and that, after a thorough search of all available material, none has been found before 1530. There are good reasons for my giving 1514 as the earliest date that an edition of "Zene Artznei" could have been published and which will be explained later on. Therefore, the first books we have to consider pertaining to the study and care of the teeth is the edition of the "Artzney Buchlein" that was published in 1530, a small forty-four page treatise by an anonymous writer.

Even prior to the time of the above mentioned writers, however, we find that in the various medical papyri, especially in Chapter (33) of the Ebers papyrus, dating about 1500 B.C., there is recorded the treatment of diseases of the teeth. There is also to be found, in the Code of Hammurabi about 2000 B.C., dental prescriptions, while Sudhoff (13), in his history of dentistry, mentions many more illustrations of recorded observations found upon the fragments of stone and clay. We thus see that our literature, interwoven with that of medicine, has an antiquity which is indeed remote.

IV. DENTISTRY'S DEBT TO MEDICINE

Before considering the strictly dental literature it would be advisable to record a partial list of those physicians and writers who gave dental literature its foundation. These men laid the ground work for all our early material prior to the time of Fauchard, and their publications should be considered as part of dental literature. The list is appended.

Abano, Petrus de (1250–1315), Rome 1473, 1484; Venice 1476, 1482, 1483, 1496, 1565; Papiae 1490; Patavii 1490, 1497. *Actuarius*, Zachar (c. 1280), Basle 1540; Venice 1542. *Actuarious*, Joannis (c. 1280), Lyons 1556. *Aetius* of Amida (502–575), Basle 1533, 1535, 1542; Venice 1534, 1543, 1553. *Africanus*, Constantinius (Isacus Israelita Chartag) (–1037?), Basel 1536; Lyons 1510, 1515; Leipzig 1894. *Agricola*, Ioa (1589–1645), Nurnberg 1646. *Albinus*, Bern (1697–1770), Leyde 1744. *Albertus Magnus* (1193–1280), Venice 1488, 1490, 1491, 1495, 1496; Ulmae 1473; Augustae 1475; Rome 1499; Leipzig 1500. *Albucasis* (936–1013), Venice 1471, 1480, 1506; Argent. 1532; Basel 1556; Oxford 1778: *Alexander*, Trallianus (525–605), Lyons 1504; Basel 1533, 1556, 1567; Strausberg 1549; Paris 1548; Venice 1552, 1570. *Altomare*, Donatus Ant. Ab. (c. 1550), Naples 1561; Lyons 1561, 1565; Venice 1562, 1570. *Anglicus*, Gilbertus (– 1230), Lyons 1510; Venice 1510. *Archigenes* (48–117). *Archimaedes* (287–212 B.C.). *Arculanus*, Ioa (1423–1484), Ferrariae 1499; Venice 1553, 1557, 1562. *Argelata*, Petrus (c. 1423), Venice 1480, 1497, 1499, 1513, 1520. *Aretaeus* (270 B.C.), Paris 1554. *Aristotle* (384–322 B.C.), Patavii 1480; Venice 1476, 1489, 1491, 1495, 1513; Leipzig 1494. *Aurelianus* (400 A.D.), Amsterdam 1755. *Auda*, Domen., di Lantosca ( ), 1666. *Avenzoar*, Abimeron(1113–1162), Venice 1490, 1497, 1530, 1549; Lyons 1531. *Averroës* (1126–1198), Venice 1527. *Avicenna* (980–1047), Venice 1482, 1484, 1486, 1490, 1514, 1582, 1592; Patavii 1479; Papiae 1521; Basel 1556, Rome 1593. *Arnaldo*, of Villa Nova (1235–1312), Mantua 1473; Nurenberg c. 1478, 1491; Papiae 1482; Venice 1494, 1497. *Baldinger*, E. G. (1738–1804), Göttingen, 1766–82. *Ballif*, Pierre N. (1775–1831). *Barbette*, Paulus ( ), Lyons 1672. *Bartholinus*, Thom. (1616–1680); Lyons 1645, 1673, 1675. *Bartholomaeus*, Anglicus (14th Century), Coloniae 1481; Nurenberg 1483; Harlem 1485; Argent. 1485, 1488; Heidelberg 1488; Frankfort 1494. *Bayrus*, Petrus (1468–1558), Basle 1578. *Benedicti* (1460–1525), Leipzig 1539. *Benedetti*, Alessandro (1460–1525). *Beauvais*, Vinzenz von (1190–1264). *Bock*, Hieronymus, also Tragus (1498–1544); Strausberg, 1544. *Bohn*, Joh. (1640–1719), Leipzig 1704. *Bromfield*, William (1712–92), London 1773. *Braunschweig* (Brunschwig) Hieronymus (1450–1533), Augsburg 1497, 1534; Argent 1500. *Burres*, Lorentz ( ), 1530. *Berengario* de Carpi (1480–1550). *Bontius*, (1598–1631), Lyons 1642. *Brogogoni*, Todercco (1205–1298), Venice 1499. *Callisen*, Henricus (1740–1824), Copenhagen 1798. *Camerarius*, Joachim (1534–), Francof. 1721. *Capivacci*, Hieron. ( ), 1589–1617. *Cardanus* (1501–1576), Lyons 1638. *Cassius*, Felix. *Castilius*, Barth. (c. 1597), Toul 1669. *Celsus*, Cornelius (25 B.C.–50 A.D.), Florence 1478, 1491; Madiosani 1481; Venice 1493,

1497, 1524, 1528; Paris, 1529; Lyons 1587, 1592, 1657. *Chantimpré*, Thom. (1201?–1263). *Chauliac*, Guy de (1298–1368), Paris 1535; Lyons 1506, 1572; Venice 1480, 1500, 1521, 1546. *Claudinus*, J. C. *Colombo* (1516–1559), Paris 1562. *Coiter*, V. *Cordo*, Simon (–1330), Venice 1510. *Croce*, Giov. Andrea, 1573. *Dekker*, Fred ( ), Lyons 1694. *De Lavauguyon* ( ), Paris 1696. *Del Papa* ( ), Firenze 1734. *Diemerbroeck*, Isbr. (1609–1674), Arenace 1646, 1696, 1698; Lyons 1679; Geneva 1679; Lyons 1727. *Dionis*, Pierre (1658–1718), Paris 1703, 1710, 1715, 1716, 1718, 1719, 1746, 1757, 1773, 1779, 1798. *Dioscorides*, Pedacius Anazarbeus (40–90 A.D.), Colle 1476; Venice 1499, 1518, 1542, 1550; Paris 1516; Basle 1542; Frankf. 1598. *Drake*, F. F. (c. 1873). *Durviunui*, Joseph (1648–1730). *Estienne*, Charles (–1564), Paris 1545. *Eustachius*. Bartol. (1520–1574), Venice 1653; Rome 1714, 1717; Amsterdam 1924. *Fabricus*, ab Aquapendente (1537–1619), Venice 1600, 1619; Patavii 1666; Leipzig 1687; Bologna 1709. *Fabry*, Wm. (1560–1634), Lyons 1641; Frankfort 1646, 1652. *Fallopius*, Gabr. (1532–1562), Venice 1563, 1564, 1606; Augsberg 1571. *Fioravanti*, Leon ( ), Venice 1570, 1620, 1660. *Forestus*, Petrus (1522–1597), Petrus 1584; Lyons 1589, 1596. *Fernelius*, Johannes (1528–1558). *Fraenko*, Pierre (1553–), 1561. *Fuchs*, Leonhart (1501–1566), Basle 1542; Paris 1546; Venice 1556. *Gaddesden*, John (1280–1361), Papie 1492; Venice 1502, 1506, 1517; Naples 1508; Augsberg 1595. *Gagliardi* ( ), Rome 1694. *Galen*, Claud. (130–200), Paris 1518; Venice 1525, 1535, 1566, 1576, 1586, 1596; 1541, 1549, 1550; Lyons 1526, 1550, 1558; Basel 1536, 1538, 1571. *Gariopontus* ( ), Basel 1536. *Gilles*, Arnauld (1165–1213) 1622. *Gordon*, Bernhard (1282–1318), Montpellier 1349;—MS; 1419 MS; Ferraire 1486; Lyons 1491; Venice 1496, 1498. *Gomez Miedes*, Bern. ( ), Valentin 1572. *Guillemeau*, Jacques (1550–1613), Paris 1612. *Haller*, Albert von (1708–1777), Lausanne 1755–56. *Haly* ben Abbas (930–994), Venice 1492; Lyons 1523. *Heister*, Laurentius (1683–1758), Nurnberg 1719, 1743; London 1743; Venice 1749. *Helmont*, Joh. Bapt. van (1577–1644), Venice 1651. *Heurnius*, Johannes (1543–1601), Lyons 1590, 1609, 1610; Patavii 1610. *Hippocrates* of Cos (460–377 B.C.), Rome 1480, 1490, 1525; Basel 1538; Paris 1545; Frankf. 1596. *Hispanus*, Petrus (1226–1277), Antwerp 1476, 1486, 1497; Lyons 1525, 1530; Frankfort 1576, 1578. *Hoffman*, Fred (1660–1742), Altorf 1708. *Hollerius* (1498–1562), Geneva 1623. *Isidors* von Sevilla. *Ingrassia* (1510–1580), Panoinic 1603. *Jassen*, Johann (1566–1621), Wittenberg 1598, 1600, 1601. *Largus*, Scribanus. *Laurentius*, Andreas ( ), Tours 1593; Frankf. 1599; Lyons 1650. *Liddel* ( ), Hamburg 1628, 1645, 1647. *Lucius* Apulyus (125 B.C.). *Lusitanus*, 1558. *Lanfranchi* (–1315), Venice 1490, 1499; Seville

1495; London 1565. *Malpighi*, Marcello (1628–1694), Venice 1698. *Mondarus* Joa. Ferra? (1461–1536). *Meuse*, Damascunus Johannes (928–1016), Venice 1491; Leyden 1539. *Montagnana*, Barthol. (–1460), Venice 1497, 1499, 1514; Pat. 1487. *Montanus*, John Baptista (1498–1551), Venice, 1554, 1558; Patav. 1556; Basle 1557. *Mundinus* ( ), Padua, 1478; Leipzig 1493; Venice 1500; Strasburg 1513. *Muys*, Joh. ( ), Berlin 1694. *Nicander*, Colophon (185–135 B.C.), Antwerp 1562. *Nicolo* Nicoli Falcucci (1357–1430), Venice 1484, 1490, 1491, 1519; Papiae 1484, 491. *Nuck*, Anton (1650–1692), Lyons 1692, 1733. *Oribasius* (326–403), Venice 1553; Lyons 1554, 1555; Paris 1851. *Orlando*, Petrus ( ), Rome 1775. *Pare*, Ambrose (1510–1590), 1564, 1582; Leyden 1604; Frankfort 1594; London 1634. *Paaw*, Petr. ( ), Leyden 1615, 1616. *Paracelsus* (1493–1541), Argent. 1573; Strausberg 1575, 1582, 1618; Basel 1582; London 1652; Frankf. 1553. *Pernumia*, I. P. ( ), Venice 1564. *Platerus*, F. ( ), Speyer 1489; Venice 1497; Lyons 1525, 1532; Basel 1614. *Paul* of Aeginea (625–690), Basel 1532, 1538. *Plinius*, Cajus Secundus (27–79), Venice 1476, 1499; Parmae 1491; Hagenau 1518; Frankfort 1582. *Purman*, G. (1648–1711), Halberstadt 1680; Leipzig 1705. *Rhasis* (Rhazes) (850–923), Berixiae 1496; Venice 1487, 1506, 1509, 1690; London 1766. *Rhumel* ( ), Nurnberg 1625. *Riverius*, Lazarus (1589–1655), Paris 1646; London 1646; Lyons 1659, 1672, 1679; Hague 1666. *Rostini*, Pietro ( ), Venice 1697. *Ryff*, Walter Herman (1500–1562), Frankfort 1545. *Rueff*, J. (1500–1558), Zurich 1554, 1587; Amsterdam 1662; Trirgui 1554. *Ruland* ( ), Frankfort 1595. *Ruysch* (1638–1731), Amsterdam 1691. *Saliceto*, Wm. v. (13th century), Venice 1502. *Saranos*, of Ephesus ( ). Ragimontii 1838. *Savonarola*, Joa. Mich. (1384?–1462), Ferran 1485; Venice 1486, 1496, 1497, 1502, 1560. *Serapionis*, Thos. (Serapta, Thom.), Venice 1479, 1497; Lyons 1525. *Serenus*, Quintus (Samonicus) (300 B.C.), Leipzig 1786, 1916. *Schelhammer* (1649–1716), Halle 1766. *Schultes*, Johann. (1595–1645), Paris 1561; St. Yves 1772; Ulmae 1655. *Scrapion*, S. (11th century), Venice 1479; Leyden 1525. *Scribonius*, Largus (47 A.D.), Paris 1529, Basle 1529; Patavii 1655. *Servetus* (1509–1553), Nurnberg 1790. *Solom*, Geraldius de ( ), Lyons 1504. *Strobelberger*, Joa. Steph. (1593?–), Leipzig 1629. *Sylvius* (De la Boe), Franciscus (1614–1672), Lyons 1671; Amsterdam 1680. *Tacuinus* ( ), Strassburg 1531–1532. *Thaddaus* of Florence (1233–1303). *Tomai* ( ), Bologna 1742. *Tulp* (1593–1674), Amster. 1641. *Valescus* de Taranta (1382–1418), Argent 1470; Lyons 1500, 1535; Frankfurt 1591. *Valverde*, Juan, de Hamusco (c. 1560–), Rome 1560; Antwerp 1572; Venice 1586. *Verduc* ( ), Paris 1735. *Vesalius*, Andreas (1514–64), Basel 1543, 1555; Lyons

1547; Venice 1556, 1568. *Vidius*, Vidus (Guido-Guido) (1500–1569), Florence 1585, 1594; Frankfort 1596. *Vigirius*, Joa. (c. 1620–). *Vigo*, Giovanni (1460–1520), Rome 1514; Lyons 1516, 1518, 1519, 1534, 1537, 1561; Paris 1530, 1537; London 1550; Venice 1556, 1560, 1581, 1588, 1639, 1677; Valencia 1557; Lisboa 1613; Nurnberg 1677.

V. THE EDITIONS OF "ZENE ARTZNEI"

The first of this series of eleven known editions was published in Germany, in 1530, by Michael Blum. Whoever the anonymous author happened to be (pages 332–333), he confined himself in this old dental book to extracts from strictly standard writers of the previous age. This work belonged to a class of medical publications of that period and later, of which a few specimens survive, and was devoted to matters of health and toilet. It had undoubtedly little standing in the profession, being written for lay readers, but it introduces to us the teachers and the teaching of the dental art as presented to laymen nearly four hundred years ago. How popular this series must have been can readily be judged, for we find that there were at least twelve editions published within forty-five years. These varied from each other in text, and differed slightly in titles.

The first edition known of "Artzney Buchlein" was issued by Michael Blum, 1530, Leipzig, 44 pp. Octavo. (*Fig. 1.*)

Second: "Zene Artzney," Peter Jordan, August 1532, Mayence, 26 pp. Quarto.

Third: "Zene Artzney," Peter Jordan, Mayence, 1532. 46 pp. This edition differed in many respects from the other 1532 edition. (*Fig. 2.*)

Fourth: "Zene Artzney," Christian Egenolph, 1536, Frankfurt a.M. 47 pp. (*Fig. 3.*)

Fifth: "Zene Artzney," Christian Egenolff, 1541, 48 pp. Frankfurt a.M. (*Fig. 4.*)

Sixth: Without title page; Michael Blum, 1543, Leipzig. 49 pp. (*Fig. 5.*)

Seventh: "Zene Artznei," Johan Daubman, Nurenberg, c. 1546-1548. (*Fig. 6.*)

Eighth: "Artzney Büchlein," pages 151-163; in the collection of "Artzney Buchleins," published by Johan Daubman, in Nuremberg, 1549. (*Fig. 7.*)

Artzney Buch-
lein/wider allerlei kran-
ckeyten vnd gebrechen der tzeen/gezogen
auſs dem Galeno/Auicenna/Meſue/
Cornelio Celſo vnd andern mehr
der Artzney Doctorn/ſeher
nützlich tzu
leſen.

M. D. XXX.

Gedruckt tzu
Leyptzigk durch
Michael Blum.
Im Jar. M. D.
XXX.

FIG. 1. Title page of the Artzney Buchlein, 1530 edition, with colophon below. First known book pertaining to the care of the teeth. It is interesting to compare the method of extraction as illustrated in this edition and in the one published in 1563. This same illustration, 1563, was used in an edition of Brunschwig (or Braunschweig) in 1539.

Zene Artzney.

Wider allerley gebre

chen vnd kranckheyt der zene viel heylſamer vnd bewerter artzneyen/gezogen auß den büchern/ Galeni/ Auicenne/ Meſue/ Cornelij Celſi/ Plinij ꝛc/ zů ſampt einem kurtzen vnd nützlichen vnderricht/ wie man geſunde zene erhalten/ vnnd die böſen holen zene odder der ſelbigen wurzeln/leichtlich on ſchaden vñ ſchmertzen/ auß zihen ſoll.

¶ Für eynen yeden gebrechen/ ſein artzney zů finden/zeyget an der inhalt folgenden Regiſters.

Getruckt zů Meyntz bey Peter Jordan jm Augſt.
M. D. XXXII.

FIG. 2. Title page and colophon of Zene Artzney, 1532 edition

Zene Artzney.

Die gůt vnnd geſundt zubehalten/ Vnnd alle gebrechen vnnd wehetagen derſelbigen on ſchaden vnnd ſchmertzen zubenemen.

Mit dem holtz Guaiaco/ das Franczoſen odder holtz des lebens genant/ alte ſchäden/löcher vnnd beulenn in geringem koſtenn vnnd gründelich zuheylenn.

Gedruckt zů Franckfurt bei Chriſtian Egenolph.

1536.

FIG. 3. Title page and colophon of Zene Artzney, 1536 edition

Zene Artzney/die gůt vnd
geſundt zubehalten/ Vnd alle gebr:e
chen vnd wehetagen derſelbigen on
ſchaden vnd ſchmertzen zubenemen.

Alte ſchäden/löcher vnnd
heulen inn geringem koſtenn vnnd
gründtlich zuheylen / Mit dem holtz
Guaiaco/das Frantzoſen oder Holtz des
lebens/ genant.

Den Erbgrindt an alten
vnd jungen zuheyln vnd widerumb
hare zuziehen.

Franc. Chr. Egen.

¶ Zů Franckfurt am Meyn/
bei Chr. Egenolff.
1541.

Fig. 4. Title page and colophon of Zene Artzney, 1541 edition

Ninth: "Zene Artznei," Chr. Egenolffs, Erben, 1559, Frankfort a.M. 77 pp. Octavo. (*Fig. 8.*)

Tenth: "Zeen Artznei," without impression, by Egenolffs, 1563. 78 pp. Octavo. (*Fig. 9.*)

Eleventh: "Artzney Büchlein," without pagination; in a collection of "Hauss Apoteck." Johann Daubman, Königsberg, 1565. 24 pp. Octavo. (*Fig. 10.*)

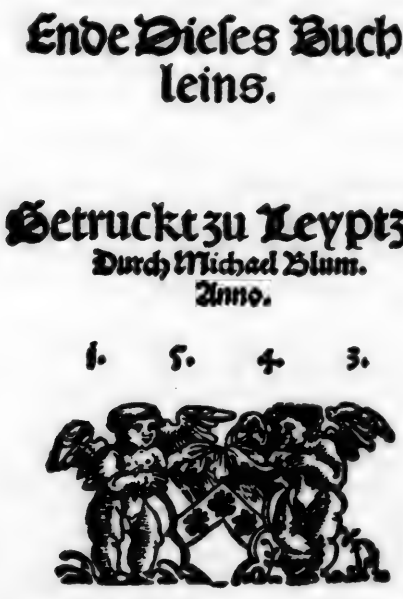


FIG. 5. Colophon of the 1543 edition; without title

Twelfth: "Zeen Artzney," Christian Egenolffs, Erben, 1576. 94 pp. (*Fig. 11.*)

I have been fortunate in obtaining and have in my possession complete photostatic copies of all but the seventh edition. We will now consider the contents of the various "Artzney Buchleins" and "Zene Artzneys."

For the first time we now have at hand a carefully edited and reviewed history by Gustave Budjuhn and Curt Proskauer (14), of some of these editions, with a reproduction of the first edition in its

Zene Artznei/die gut vnd
geſundt zubehalten / Vnd alle gebrechen
vnd weheragen der ſelbigen ohn ſchaden
vnnd ſchmertzen zu benemen.

Alte ſchäden/Löcher vnd
bewlen in geringē koſten vnd gründelich
zu heylen/Mit dem holtz Guaiaco/das
Frantzoſen oder Holtz des lebens genant.

Den Erbgrindt an alten
vnd jungen zu heylen vnd wide-
rumb harzu ziehen.

Gedruckt zu Nürenberg
bey Johañ Daubman.

FIG 6. Title page of Zene Artznei, 1548 edition

Artzney Büchlein wi-
der allerley kranckheiten vnd gebrech
en der Zene/gezogen auß dem Gale
no/Auicenna/Mesue/Corne
lio Celso/vnd andern mehr
der Artzney Doctorn/
sehr nützlich zu
lesen.

Gedruckt zu Nürn-
berg durch Johañ
Daubman.
Anno/
M. D. xlix.

Fig. 7. Title page and colophon of Artzney Büchlein, 1549 edition

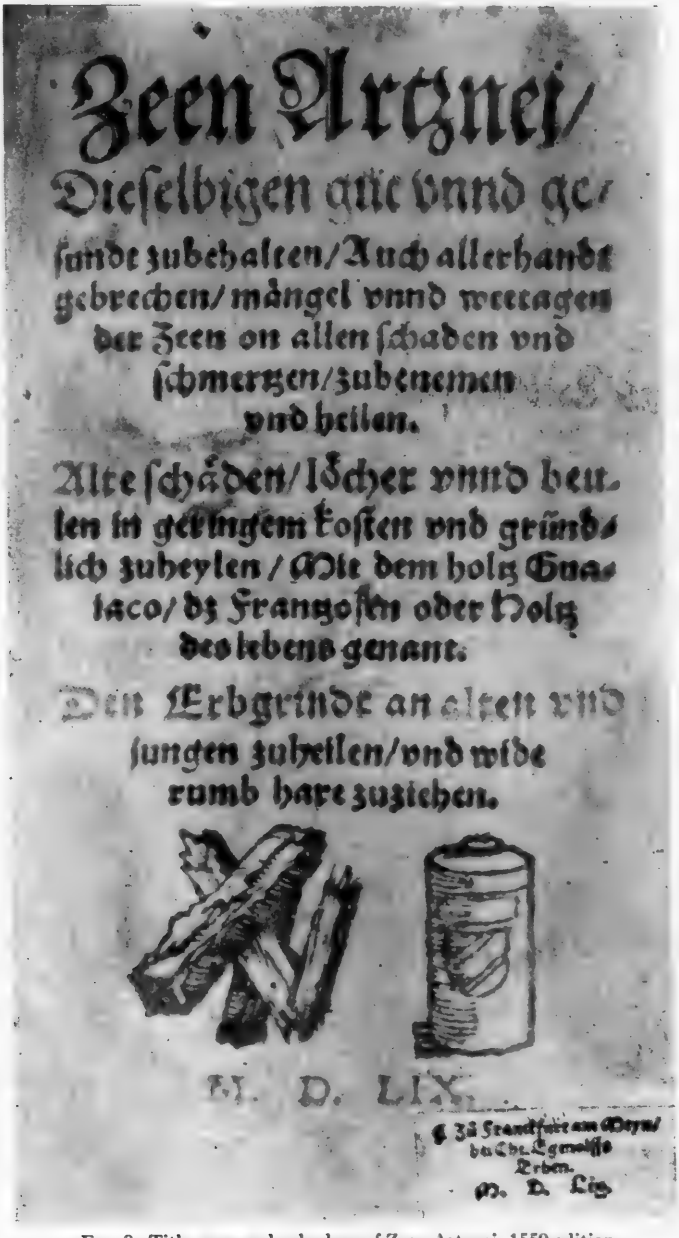

Zeen Artznei/
Dieſelbigen gute vnnd ge-
ſunde zubehalten/Auch allerhandt
gebrechen/mängel vnnd weetagen
der Zeen on allen ſchaden vnd
ſchmertzen/zubenemen
vnd heilen.
Alte ſchäden/löcher vnnd beu-
len in geringem koſten vnd gründ-
lich zuheylen/Mit dem holtz Gua-
iaco/dz Frantzoſen oder Holtz
des lebens genant.
Den Erbgrindt an alten vnd
jungen zuheilen/vnd wide
rumb hare zuziehen.
M. D. LIX.
Zu Frandfurt am Meyn/
bey Chr. Egenolffs
Erben.
M. D. Lix.

FIG. 8. Title page and colophon of Zeen Artznei, 1559 edition

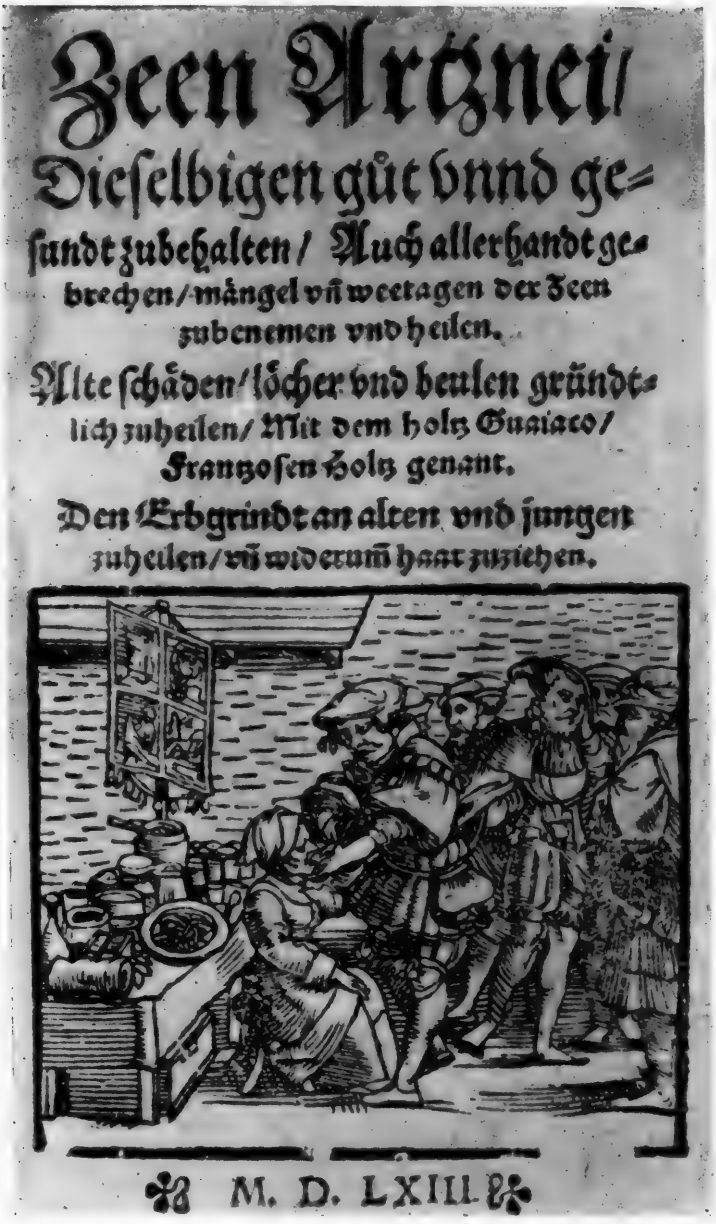

Zeen Artznei/
Dieselbigen gůt vnnd ge=
sundt zubehalten/ Auch allerhandt ge=
brechen/mängel vñ weetagen der Zeen
zubenemen vnd heilen.
Alte schäden/löcher vnd beulen gründt=
lich zuheilen/ Mit dem holtz Guaiaco/
Franzosen Holtz genant.
Den Erbgrindt an alten vnd jungen
zuheilen/vñ widerumb haar zuziehen.
M. D. LXIII.

FIG. 9. Title page of Zeen Artznei, 1563 edition

Artzney Büchlein /

wider allerley Kranckheiten vnnd gebrechen der Zene / gezogen auß dem Galeno / Auicenna / Meſue / Cornelio Celſo / vnd andern mehr der Artzney Doctorn / ſehr nützlich zu leſen.

Oo iij Inhalt

FIG. 10. Title page of Artzney Büchlein, 1565 edition. The letters at the bottom are guides to pagination; used in all early books in place of numerals.

Zeen Artzney/

Dieſelbigen gut vnnd geſundt zubehalten/Auch allerhand gebrechen / mängel vnd weetagen der Zeon zubeneimen vnd heilen.

Alte ſchäden/löcher vnd beulen gründlich zuheilen/Mit dem holtz Guaiaco/Frantzoſen Holtz genant.

Den Erbgrindt an alten vnd jungen zuheilen/ vnd widerumb haar zuziehen.

Cum Priuilegio Imperiali

M D. LXXVI

FIG. 11. Title page of Zeen Artzney, 1576 edition

entirety. I have written at great length, in my "Orthodontics: An Historical Review of its Origin and Evolution" (15), concerning the problems relating to irregularities of the teeth and the treatment as found in the first edition. The contents of other editions are indicated in the unsigned translation in the *Dental Cosmos*, January 1887—the 1541 edition; *Dental Register*, August 1891, by W. T. (not William Trueman) one of the 1532 editions; and *International Dental Journal*, June 1898, by William H. Trueman—the other 1532 edition. The 1559 edition is described by Koch in his History (16), on page 22. They are all worth reading.

A. Contents: first edition

The 1530 edition is divided into thirteen chapters, with titles as follows:

The first chapter/ When and how many teeth grow in man.

The second chapter/ By what causes the teeth are ruined.

The third chapter/ How to assist children so that their teeth may erupt easily.

The fourth chapter/ Of toothache.

The fifth chapter/ Of hollow and decayed teeth.

The sixth chapter/ Of tooth on edge.

The seventh chapter/ Of yellow and black teeth.

The eighth chapter/ Of depressed (impacted) teeth.

The ninth chapter/ Of loose teeth.

The tenth chapter/ Of worms in the mouth.

The eleventh chapter/ Ulcerations, bad smells, and diseased gums.

The twelfth chapter/ How to extract bad teeth.

The last chapter/ How to retain good teeth.

In the preface attention is called to the fact that the teeth are necessary for speech, for when lost or injured they interfere with it, and if elongated should be extracted. Teeth are necessary, as in animals, not only to secure food, but to prepare the food in order to perform nature's work properly, otherwise the stomach becomes weak and consequently other organs will become involved. The first chapter states, in substance: Some are born with teeth, but usually they begin to erupt in the seventh month after birth and continue until we have thirty-two. To some the teeth come easier,

to others more painfully; to some sooner, to others later. The second cautions the retention of teeth, if possible. Care should be taken properly to cleanse them and to remove all particles of food that remain between the teeth. Indigestion should be avoided and a heavy meal should not be eaten before retiring. Care should also be taken not to bite on hard substances.

It will be of interest to review these editions in some detail, as this has never been attempted. The title pages differ from each other in arrangement of type and spelling. We find, from the illustrations of the 1530, 1549, and 1565 editions, a difference in the method of operative procedure as portrayed in the 1563 and 1576 editions. The first shows us the interior of a crude dental "office," the operator standing behind and slightly to the left of the patient, with a long-handled forceps, extracting a tooth, the patient's head resting against the thigh of the operator. The other illustration was first used by Brunschwig (or Braunschweig) in his "Thesaurus paperum," 1539. It was engraved by Jean-Sebald Behan, Nüremberg (1503-48). This wood-cut gives us an idea of the then travelling dentist, under the sheds of Nüremberg, in the midst of soldiers, gentlemen, and nobles. Extracted teeth surround the sign-board as a garland. The table is used as a support for the patient. We rarely find a woman as a patient among the reproductions. The operator has assumed a more truly normal position for extraction.

B. Variations noted in different editions

Title page

1530. Artzney Buch/lein, wider allerlei kran/ckeyten und gebrechen der tzeen/getzogen ausz dem Galeno, Avicenna, Mesue, /Cornelio Celso und andern mehr/der Artzney Doctorn, seher/Nützlich tzu/lesen/M.D. XXX. *Colophon:* Gedruckt tzu Leyptzigk durch/Michael Blum/Im Jar M.D./XXX./

1532. Zene Artzney./Wider allerley gebre/chen und kranckheyt der zene iel heylsamer und be-/werter artzneyen, gezogen aus den büchern, Gale-/ni, Avicenne, Mesue, Cornelii Celsi, Plinii & c, zů/sampt einen kurtzen und nützlichen underricht,/wie man gesunde zene erhalten, unnd die bö-/sen holen zene odder der selbigen wur-zeln, leichtlich on schaden un(d) schmer-/tzen, ausz zihen soll. (Fur eynen yeden gebrechen,

sein artzney zu/finden, zeyget an der inhalt folgenden/Registers./*Colophon:* Gedruckt zu Meyntz bey Peter Jordan im Aug(u)st/M.D. XXXII.

1536. Zene Artzney./Die gůt unnd gesundt zubehalten, unnd/alle gebrechen unnd wehetagen derselbigen on schaden/unnd schmertzen zubenemen. *Colophon:*/Gedruckt zu Franckfurt bei/Christian Egenolph/1536/

1541. Zene Artzney, die gůt und gesundt zubehalten, Und alle gebre/chen und wehetagen derselbigen on/schaden und schmertzen benemen. Franc Chr. Egen. *Colophon:*/Zu Franckfurt a/Meyn, /bei Chr. Egenolff./1541.

1543. Title missing. *Colophon:* Ende dieses Buch/leins./Getruckt zu Leyptzig/Durch Michael Blum./Anno./1.5.4.3./

1548. Zene Artznei/die gut und gesundt zubehalten/Und alle gebrechen und wehetagen derselbigen ohn sehden unnd sehmertzen zu benemen. *Colophon:* Gedruckt zu Nürenberg ben Johañ Daubman.

1549. Artzney Büchlein wi-der allerley kranckheiten und gebrech en der Zene/gezogen ausz dem Gale/no/Avicenna/Mesue/Corne/lio Celso/und andern mehr/der Artzney Doctorn/sehr nützlich zu/lesen. *Colophon:* Gedruckt zu Nüren-berg durch Johañ/Daubman./Anno/M.D. XLIX.

1559. Zeen Artznei,/Dieselbigen gut unnd ge/sundt zubehalten, Auch allerhandt/gebrechen, mängel unnd weetagen/der Zeen on allen schaden und/schmertzen, zubenemen/und heilen. *Colophon:* /Zu Franckfurt am Meyn/bei Chr. Egenolffs/Erben/M.D.L. IX./

1563. Zeen Artznei,/Dieselbigen gůt unnd ge/sundt zubehalten, Auch allerhandt ge-/brechen, mängel uñ weetagen der Zeen/zubenemen und heilen./M.D.L.XIII. *Colophon:* None.

1565. Artzney Büchlein/wider allerley Kranckheiten unnd gebrechen der Zene/gezogen ausz dem Ga leno/Avicenna/Mesue/Cornelio Celso/und andern mehr der Artzney Doctorn/seher neützlich zu lesen Oo iij Inhalt. *Colophon:* None.

1576. Zeen Artzney,/Dieselbigen gut unnd ge-/sundt zubehalten Auch allerhand/gebrechen, mängel unnd weetagen der Zeen/zubenemen und heilen. *Colophon:* Gedruckt zu Franckfort/am Mayn, bey Christian Egenolffs Erben, In verlegung Doct:/Adami Loniceri, Doct: Johannis/Cnipij, und Pauli Stein/meyers (Egenolff's son in laws), Im jar nach der/Geburt Christi un/sers Erlo/sers/M.D.L.XXVI.

Contents page

The contents of the 1530 edition occupies one page. All chapters begin with the word "Das" and are printed in German. It contains

but thirteen chapters. The 1532 edition has the same arrangement, except teeth are spelt "Zene" and not "Zeene," "Zehn." The 1536 edition is similar to the preceding ones, with six additional subject titles relating to syphilis. The 1541 edition has two columns to a page, the first half containing nine chapters, while the second half presents the tenth to thirteenth chapters with six additional items but no subject title. My photostatic copy of the 1543 edition lacks the title page and contents; but, as it has two columns to a page and the second column begins the first chapter, with the first column blank, we are led to assume there was no contents page to this edition. The 1549 edition has the one column arrangement, with the numbers for chapters three to the last printed in Roman numerals; no additional material. The 1559 edition has a column and a half of "contents," beginning with "Das erste," while chapters two to thirteen are in Roman, minus the word "Das." The second page contains no subject heading, but has seven citations to other material. The 1563 edition is worded exactly as the 1559 edition. In the 1565 edition, the "Inhalt dieses Bůchleins" is divided into two lines, and in arrangement is similar to that of the 1549 edition, except that the chapter numbers begin with a capital and are written in German throughout. In the 1576 edition there are two columns to a page, with the first chapter in one column beginning, "Das erst," and the next thirteen indicated by Arabic numerals, with the seven additional "content." The second column begins the introduction.

I have already called attention to the illustrations portraying the dental operations as pictured on the title pages. The wording is practically the same in the 1530, 1532, 1549 and 1565 editions, except that the 1532 editions begin with the word "tooth" and refer by name, to five authorities. Galen ending in o in the 1530, 1549, and 1565 issues: in i in that for 1532. In the 1532 edition, the last a in Avicenna is changed to e. In this same edition the last o in Cornelio and Celso is changed to i, with the name of Plinii added as well as some other information relating to the teeth. The editions for 1536, 1541, and 1548 are worded almost alike; those for 1559, 1563, and 1576 are similar in wording although the spelling of a few of the words is slightly different.

Introduction

The make-up of the Introduction (vorrede) varies considerably. In the 1530 edition there is a page and a half to this, balanced at the bottom of the second page by an artistic scroll. The 1543 is similar in arrangement. The first page of the 1543 edition contains 24 lines, the second 17, a total of 41; while in the 1543 edition there are 25 lines on the first page and 18 on the second, 43 in all. In the 1549 edition this material is condensed into 28 lines and on one page. The beginning of the Introduction in the 1532 and 1536 editions also differs from the preceding ones, by using twelve words more before the wording begins to correspond. This Introduction is printed on one page. The 1532 edition has thirty lines, while that for 1536 has twenty-eight. The issues for 1539, 1563, 1565, and 1576 do not contain the Introduction.

Chapters

Chapter 1. The 1530 edition begins with "Das Erst Capittel;" the sub-title is printed in two lines. This arrangement is also found in the 1532, 1543 and 1565 editions. The two t's in "Capittel" are also found in the 1532, 1543, 1563, and 1576 editions. In the other editions it was spelt with but one t. In the 1549 edition, "Capittel" is abbreviated to "Cap." In the 1536, 1541, 1549, 1563 and 1576 editions the word "Das" was dropped and only "Erst" used. In 1530, Chapter 1 continued to p. 2 (a.iiji). In 1532, it is printed on one page; in 1536, on three-quarters of a page; in 1541, on two pages; in 1543, on a page and a quarter; in 1549 and 1565 as in 1532; in 1559 and 1563 as in 1541; in 1576, on a page and three-quarters. In 1530, 1532, 1549 and 1565, the editions were printed one column to a page, while those in 1536, 1541, 1543, 1559, 1563 and 1576 contained two to a page. In 1530, 1532, 1549, 1565 and 1576 they contained only the part relating to the teeth. In the editions for 1541 and 1543, an additional page was devoted to other matters; in 1536, two pages; while in those for 1559 and 1563 there are two long articles on syphilis and the hair. The 1576 edition ends with a verse from Eziah 14, and Psalm 91. The differences in arrangement and size of type account for the variation in the number of pages.

With the exception of the 1549 and 1565 editions, the text proper starts with the word "Zum," in this edition the word "Am" is used.

One of the 1532 editions lacks the last three paragraphs of Chapter 9; also Chapters 10, 11 and all of 12 except the last paragraph. Chapter 5 contains the reference by Mesue to the use of gold foil in filling teeth supposedly prior to Arculanus (17). I have personally examined over twenty editions of Mesue (18) and cannot find a reference to gold used in this manner, although Mesue mentions gold in this section on four occasions.

C. Authorities Quoted in this "Buchlein"

Only three of the eleven editions contain marginal notes: those for 1530, 1532 and 1543. In *Chapter 1* of the 1532 edition there is a reference to "Plinius, libro 7, cap. 16; and lib. 11, cap. 37" (twice each); the other two lack this notation. *Chapter 2* is based upon "Avicenna 7, lib. 3, cap. 2;" "Mesue, summa 8, cap. pprio 'de corrup.' coloris de dentium;" and "Avicenna twice as stated." In the 1530 and 1543 editions these references were separated, while in that for 1532 the last three were brought together. *Chapter 3:* "Avicenna, etc." as shown in the illustration. (*Fig. 12.*) *Chapter 4:* "Johannes de Figo." This marginal note does not appear in the 1530 or 1543 editions. "Mesue, ut sup," "Avicenna 7, lib. 3, cap. 6 & 7"; also "lib 2, de simplicib. cap. 66; Mesue ut sup." Avicenna. "Libr 2 de simplicib. ca 596." is not found in the 1543 edition. *Chapter 5:* "Mesue, ut sup. capiti pprio." *Chapter 6:* "Johannes de Figo," appears only in the 1532 edition. "Haec Mesue cap. de congelatione." *Chapter 7:* "Mesue cap. proprio." *Chapter 8:* None. *Chapter 9:* "Avicenna, na et; Mesue. cap. pprijs;" also "prima parti. sectiois prima cap. pprio. Cornelli Celsus." This reference does not appear in the 1530 or 1543 editions. *Chapter 10:* No marginal notes. *Chapter 11:* "Mesue ubi supra." *Chapter 12:* "Mesue, ubi sup. cap. pprio de extractione dentium; Ex Mesue, ubi supra." This last reference is found only in the 1530 and 1543 editions.

We thus see that this work was compiled from the writings of six men. Even in the use of marginal references there is considerable variation, though we find only eleven direct indications of names: Pliny, twice in all editions; Avicenna, once; Mesue, seven times in

vnnd groſſen ſchmertzen kommen magk
man die nachuolgenden ſtücke ane verlig-
Auicen keyt gebrauchen vnd ſeind dy furnemſten
tertia außgeleſene ane ſchaden.
fen.pri.
lib.doc. Zum erſten ſal man die kindergē (den
1.cap.2. die zene ſawer werden) vffte baden/ vnd
Meſue das tzan fleiſch nach dem bade vft mit ei-
capite nem finger der in warmen hünner genſen
pprio ader enthē veth getuncket iſt/ſubtil reiben
de gene do man ſich der tzene zu kummen vormut
ratione drucken/ dach das yn nicht alzuwehe ge-
dentiū. ſchehe/Auch magk man das gehyrn von
Auicen einem haſen nemen vnd der gleichen vffs
lib.2.de tzanfleiſch aber mit wintzigem yzt genan
ſimpli. ten vetthe vormengt vff die wenglichen
ca.397. ſtreichen aber vō außwendigk drof legen.
Prima
parti. Darnach magk man auch nemen als
ſectiōis der Meſue ſpricht pappeln / Steinklee/
prime. camillen oder hermlichen/ dülle in waſſer
ſumā.8 geſoten vñ den halß/das heubt/dy weng-
capite lichen dar mitte pehen/ weichen vnd wa-
de gene ſchen.
ratione So aber die tzene beginnen tzuerſchey-
dentiū. nen vnnd herfur zu kommen/ſo nim feyn
ſubtile

Fig. 12. A page in the third chapter of the Artzney Buchlein, 1530 edition. Marginal notes explain the citations and authorities.

1530, five in 1532 and 1543; Figo, twice; Celsus, once; Galen in 1530 and 1543. There are thirty-two marginal notations in the 1532 edition; in 1530, twenty-five; 1543, twenty-one.—Pliny: 1530, none; 1532, four; 1543, none. Avicenna: 1530, fifteen; 1532, ten; 1543, ten. Mesue: 1530, ten; 1532, fifteen; 1543, eleven. Figo: 1530 and 1543, none; 1532, two. Celsus: 1532 only. It is by this study of marginal references that I am firmly convinced there can be no copy of this work before 1514. Johannes de Vigo was born in 1460 and died in 1520, his first edition of "Practica in arte chirgica copiosa" having been published in Rome in 1514, fol. Lugd. 1516, 8°, 1516, 4°, 1519, 8°, 1534, 8°, 1561, 8°. As we find two direct references to Vigo's writings, this fact tells us this part of the story.

D. Miscellaneous data

There is considerable variation in the spelling throughout the different editions, as well as in other arrangements, etc. The issues for 1541, 1559, 1563 and 1576 contains at the top of each page the title of the book, the other editions lack this. In the "Daubman" edition of 1546-8, owned by Weber, the fifth chapter with the portion relating to the filling of the teeth with gold is headed "Zene Ertzney," but this change of the "A" to "E" is found on only that one page.

Perhaps one of the most important and significant changes to be found is in Chapter 12, second paragraph. Here we find a reference to a Meister Lorentz who treated a boy of eight or nine years of age. It is supposed by Prinz and myself that this Lorentz was detailed by the publisher to compile this book, and that he might be the anonymous author. However, I state this merely for what it might be worth and not as a fact. This portion is found only in the 1530, 1543, 1549 and 1565 editions; in fact the beginning of the Chapter and the general wording differs in these editions from the others.

E. Conclusions

At least four different printers in various cities were interested in the publication of the twelve known editions of the "Zene Artzney"—1530 and 1543: by Blum; 1532: both by Jordan; 1536, 1541, 1559,

1563 and 1576: by Egenolph; and 1546–8, 1549, and 1565: by Daubman. They all vary in many respects from each other: three with marginal notes; the four by Egenolph have the title at the head of each page; and only four have a reference to "Meister Lorentz." The illustrations on the title pages in 1530, 1549 and 1565 are alike, while those in 1563 and 1567 are similar. From the marginal notes we are convinced that, if this is the first dental book—and from all evidence this series is entitled to that credit—it could not have been written before 1514, and certainly not, as Weber states, "c. 1509;" and that the anonymous writer might perhaps have been the "Meister Lorentz," referred to in Chapter 12.

F. Inventory of the various editions

It is of interest and value to record here the ownership of existing copies of the various editions of these rare and significant books.

Edition of 1530

1. Edward Cameron Kirk, Thomas W. Evans Museum and Dental Institute, School of Dentistry, Philadelphia, Pa.
2. Ratsschulbibliothek, Zwickau i. Sa., Germany.

Edition of 1532

1. H. J. McKellops, Dental Department, Washington University, St. Louis, Mo. Complete copy
2. William Trueman, Northwestern University, Chicago, Ill.
3. Staatsbibliothek, Berlin, Germany
4. Staatsbibliothek, Berlin, Germany
5. Universitätsbibliothek, Bonn, Germany
6. Universitätsbibliothek, Jena, Germany

Edition of 1536

1. Library, British Dental Assciation, London, England
2. Staatsbibliothek, Berlin, Germany
3. Staatsbibliothek, Munchen, Germany
4. Staatsbibliothek, Frankfurt, Germany
5. Curt Proskauer, Breslau, Germany
6. Floristan Aguilar, Madrid, Spain

Edition of 1541

1. *Dental Cosmos*, Philadelphia, Pa.
2. Staatsbibliothek, Berlin, Germany
3. E. Sauvez, School of Dentistry, Paris, France

Edition of 1543

1. Staatsbibliothek, Berlin, Germany

Edition of 1546–8

1. Andrés Weber, Havana, Cuba

Edition of 1549

1. Collection of "Artznei Büchlein," by Ocyrus or Schnellenberg, College of Physicians and Surgeons, Philadelphia, Pa.

Edition of 1559

1. Universitätsbibliothek, Bonn, Germany
2. Universitätsbibliothek, Munchen, Germany

Edition of 1563

1. Staatsbibliothek, Berlin, Germany
2. Universitätsbibliothek, Erlangen, Germany
3. Universitätsbibliothek, Freiburg, Germany
4. Senckenbergische Bibliothek, Frankfurt, Germany

Edition of 1565

1. Boston Medical Library, Boston, Mass. A series of "Hauss Apoteck," sixteen in number. Number 12 is the one relating to dentistry.

Edition of 1576

1. H. E. Friesell, University of Pittsburg, Pittsburgh, Pa.
2. Fritz Lejeune, Greifswald, Germany
3. Universitätsbibliothek, Erlangen, Germany

Complete photostatic collection of all but the 1546–8 editions: B. W. Weinberger, New York City.

VI. THE BOOK BY WALTER HERMANN RYFF (GUALTHERUS H. RIVIUS; RUFF, RIFFUS, RIVIS, RIEF, RYF, RYFFUS), 1500-62

The next exclusively dental book of which we have record was also published in German, in 1548. This book may justly be considered

the beginning of original work in dental literature. It is the earliest known to have been written by a practitioner, and is distinguished as the first for the profession, in other than the Latin text. To Ryff honor must be given for the first important work devoted to dentistry: "Nützlicher bericht, wie man die Augen und das Gesicht . . . . wie man den Mundt, die Zän and Biller frisch, rein, sauber, gesund, stark und fest erhalten." (*Fig. 13.*) There was little in it that was original. Its principal merit consists in the fact that it was the first dental book in a language other than Latin, and may be looked upon as the earliest work endeavoring to impart to the common people the knowledge of medicine, dentistry, and hygiene. Until recently Ryff was considered one of the greatest plagiarists of his time. Even Vesalius complained of the manner in which he copied his anatomic material. However, a careful examination of the anatomic plates of Vesalius, printed in Venice in 1538, and those of Ryff, in 1542, shows Ryff's to be a marked improvement and a decided step forward in the conception of the human skeleton. Ryff's Major Chirurgia in 1545, and his Minor Chirurgia in 1542, contain a number of illustrations of dental forceps. These were obtained, however, from various works such as those of Albucasis (19), Fabricus (20), Dryanders (21), and Arculanus (17), and were not original with him.

The pamphlet, printed in Würzburg, contains 61 pages, and is divided into three parts, the first of which is devoted to the eyes, the second to the teeth, and the third to first dentition. The second and third parts, as found in my copy (a photostat of the one in the Surgeon-General's Library at Washington), contain little that is original. The ten rules for preserving the teeth and for their care are taken from the work of Arculanus, and are as follows: (a) It is essential to guard against the corruption of food and drink within the stomach; such food as milk and salt fish must not be eaten; shortly after meals exercise, bathing, etc., should be avoided. (b) Meat and other foods that might cause vomiting, and (c) desserts and sweets, such as honey, should not be eaten. (d) One should not bite hard things. (e) One should avoid all substances that can set the teeth on edge. (f) All things that are too hot or too cold must be avoided, and especially taken in rapid succession, hot or cold, or cold or hot drinks. (g) Onions should not be eaten, as they are

Nützlicher bericht / wie

man die Augen vnd das Geſicht / wo das ſelbig mangelhafft / blöde / dunckel oder beſimſtert. Scherpfen / geſundt erhalten / ſtercken vnd bekreffrigen ſoll.

Mit mancherley ſonderlichen nützlichen vnd bewerten Augen Artzneyen / als kreffrige Augenwaſſer / Collyria / Augen pulffer / Confect / Latwergen vnd dergleichen einfachen vnd vermuſchten Artzneyen / dardurch nit allein die Augen vnd das Geſicht / ſonder auch das Hirn vnd Gedechtnus / geſtercket vnd geſcherpffet werden / innerhalb vnnd auſſerhalb des Leibs / vilfaltiger geſtalt nützlich zu brauchen.

Allen denen welche jr Geſicht mancherley handtierung halb / hefftig üben vnd ſcharpff brauchen müſſen / vñ nit allezeit verſchonen künden / vber die maß nützlich vnd hoch von nöten.

Mit weitterer vnterrichtung.

Wie man den Mundt / die Zän vnd Biller / friſch / rein / ſauber / geſund / ſtarck / vnd feſt erhalten /

Allen weethumb vnd ſchmertzen / fealnus / geſtanck / ſchwertze ſampt allen ſchedigungen derſelbigen mit bequemen Zän pulfferlin / Zänwaſſeren / Dennfrua vnnd dergleichen mancherley kreffriger mittel / der Artzney / ſchnell vnd leichtlich vertreiben mög

Zu gemeiner wolfart neulich inn Truck verordnet. Durch D. Gualtherum H. Riuium Medicum & Chirurgum.

Mit Römiſcher Kay: May: Priuilegio.

FIG. 13. Title page of Ryff's Nützlicher Bericht, 1548. The titles found in various bibliographies and histories are not correct, as is shown by this reproduction.

injurious to the teeth. (h) Teeth should be cleansed after each meal, using a thin piece of certain wood he mentions, but care must be taken not to injure the gums. (i) After each meal it is necessary to rinse the mouth with a good strong wine, or a mixture of various herbs. (j) The teeth must be rubbed before going to bed, or in the morning, with a suitable dentifrice. The third part relating to dentition in young children is very similar to that recorded in the third chapter of the "Artzney Buchlein."

Considering the number of editions of "Zene Artznei," it is strange that Ryff fails to mention the treatment of carious teeth or their filling with gold, especially in the third part relating to young children. Arculanus (17), a half century before, recorded this fact as being of common practice. From the similarity of Ryff's ten rules for preserving the teeth, in the first pages of the book, to those of Arculanus, Ryff certainly must have had some knowledge of this author's ideas and work.

VII. THE BOOK BY JOHANNES DIGITUS OF HOPFFERSTADT

Following the series of "Zene Artznei" and the treatise of Ryff's just mentioned, there is another book. Sudhoff, on page 152 of his History of Dentistry (13), gives only the correct title and a paragraph relating to the preface. It has been my good fortune to receive through Mrs. Lillian Lindsay, of the British Dental Association, a photostatic copy of this interesting book. With the exception of Sudhoff's History, no dental history or bibliography records this particular work: "Nutzliche || Vnd bewerte, || Artzneyen fur allerhand || zanwehe, sonderlich aber fur den schmer- || tzen der kompt, von auff vnd abstei- || genden kalten vnd warmen || flussen des haupts || vnd magens."

The preface indicates that this manuscript was completed on July 19, 1586, and turned over to Bernhard Dalbin, a printer in the city of Speyer, who published it on October 25, 1586. Digitus apparently was a student of medicine and a great reader of classical medical writers of the early period of medicine. He based his book on the writing of authorities who, with the exception of Galen, Hippocrates, and Pliny, had not previously been considered by early dental students, namely, Arnold of Villanova (1235-1312), a Spanish doctor

Nutzliche Vnd bewerte/ Artzneyen fur allerhand zanwehe/ sonderlich aber für die schmertzen der da kompt/ von auff vnd abstei-genden kalten vnd warmen flüssen des haupts vnd magens.

Allen den Jenigen so mit dieser kranckheit beladen vnd behafftet seind oder werden/ zu gut gestelt/ fürnemlich aber dem gemeinen man.

Durch

Iohannem Digitium Hepfferstadensem Francum, Medicinarum studiosum.

Getruckt zu Speyer

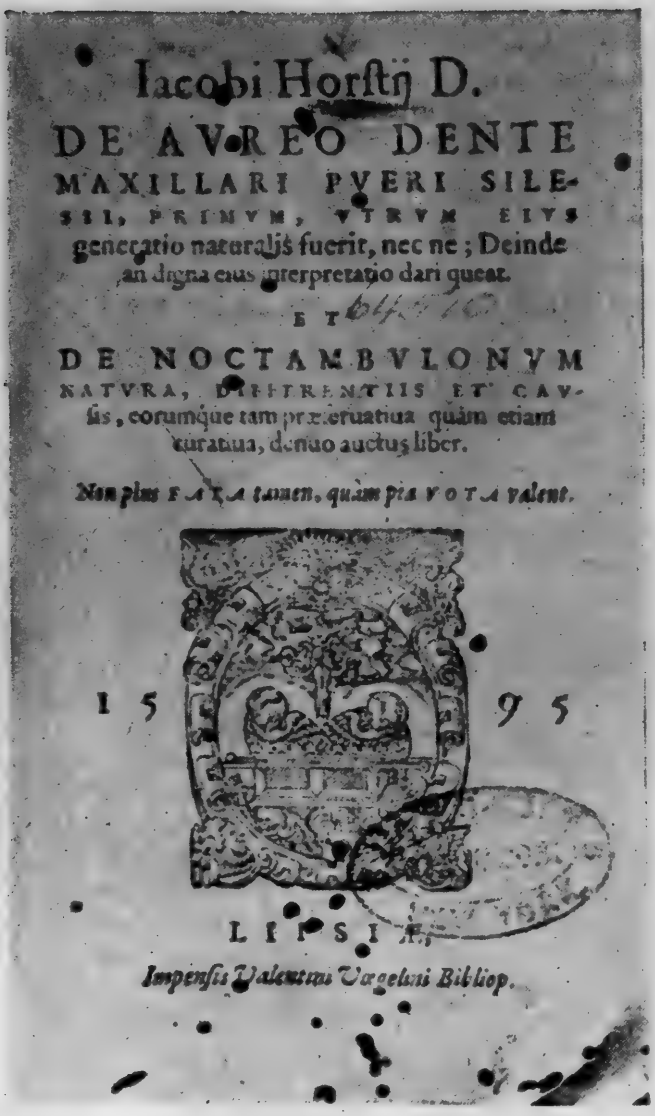
Bey Bernhardt Dalkin.

1 5 8 7.

FIG. 14. Title page of an unrecorded dental book by Johannes Digitus, 1587

of theology, law, philosophy, and medicine, and physician to Peter III of Aragon; Petro Bayra or Baiiro, about 1507; Bernard de Gordon, "presumably a Scotchman, who taught at Montpellier from 1285-1307; Hieronymus Bock, called Tragus (1498-1554), and Archigenes a contemporary of Celsus.

The work consists of 22 pages. 16° in size. The *title page* is reproduced in *figure 14*. Following the title page is the *dedication*, in Latin, to Galini, Arnaldi, Bauri, Gordonii, and Hippocratii, a Greek passage from "Syrach. cap. 38." closing with another Latin phrase. On *pages 3, 4 and 5* are remarks by the publisher Dalbin. *Pages 6 and 7*, the preface, give four reasons for writing the book. *Page 8:* Von zal und kranckheidten der zaene. Das erst capittel. "οδοντες" Dentes. The first chapter opens with the nomenclature of the teeth given in both Latin and Greek. Marginal notations: Galen, libr. II de usu. part. ca. 8; Galen, libro. de ossib. cap. 5; Hipp. lib. de corn. *Page 9:* Aristot. libri 2 de historia animal. cap. 4. *Page 10:* Von besachen das zanwehes. Das ander Capittel; Aus al. Villa libri; Bren. pra. cap. 45. *Page 11:* Joá Fern. de part. mort and symp. cap. 8°; Gal libri, de ossib c. 5. li. 5 de cap. med. local c. 8. *Page 12:* Vonn merckzeuchen des zanwehes das ist von zeichen das aug man erkennen kan wo der schmertz herkomme. Das drit Capittel; Arnal do. Vil. lib. 5; Bren. pra. cap. 45. *Page 13:* Gor. part / 3 de pas / ous c. 25; Arn. Vil. Bre. pra. cap. 45. *Page 14:* Wie man den Schmer tzen der zaene der von warmer absteigen der feuchte des birns und auffstei gender des magens kompt stillen und curiren sol. Das viert capittel; Arnal. Vi. lib. 1; Bren oract. C. 4. *Page 15:* Content of a prescription. *Page 16:* Gor. par. 8. de pass. dent. c. 25. Wie man den Schmer tzen der zaene der von falten absteigender feuchte der haupts oder aussteigenden des magens kompt stillen und curiren soll. Das fuenfft Capittel. *Page 17:* Arn. Vil. libr. 1; Br. pract. c.?; a prescription. (Hier. Tra. in seinem Kreutterbuch.) *Page 18:* Arn. Vil. lib. Br. pt. cap. 45. *Page 19:* Wie man zene die wacke lein wiederum soll steiss machen. Das Sescht Capittel; Archigenes; Gal. lib. 6. de com. phar. secund lac.; Pet. Bayr. lib. 6. prac. cap. 10; Gal. lib. 5. di comp. phamac. secund. loc. *Page 20:* Wie man zene ohn schmertzen soll aus fallen machen. Das 7 Capittel Crito; Gal. lib. 5 di com. pharm. secund. loc. *Page 21:* Petr. Bayrus. lib. 6. pr.


Iacobi Horſtij D.

DE AVREO DENTE MAXILLARI PVERI SILESII, PRIMVM, VTRVM EIVS generatio naturalis fuerit, nec ne; Deinde an digna eius interpretatio dari queat.

ET

DE NOCTAMBVLONVM NATVRA, DIFFERENTIIS ET CAVSIS, eorumque tam præseruatiua quàm etiam curatiua, denuo auctus liber.

Non plus FATA tamen, quàm pia VOTA valent.

1595

LIPSIÆ,

Impensis Valentini Vuegelini Bibliop.

FIG. 15. Title page of the book by Jacobi Horstii (1595); the Story of the "Golden Tooth."

cap. 14; Arn. Vill. Lib. 5. Bren pra c. 45. *Page 22:* Das die zen den kindern leichtlich wachsen. Das acht und letz capittel; P. B. lib. 6. pract. c. 9; Gord. pra. 3. de pas. de rub. 5; Endt Appendix.

We thus see that this work was divided into eight chapters. Digitus considered the care of the teeth and the treatment of "toothache," basing it upon the observations of nine classical authorities as follows: Galen (22), 6 references, Hippocrates (23), 1; Aristotle (24), 1; Arnold of Villanova (25), 7; Joa Fernal (26), 1; Gordon (27), 3; Tabernaemontaus (28), 1; Pet. Bayer (29), 3; Archigenes (30), 1.

To this group, two others belonging to the sixteenth century, by Martini Rulandi and Jacobi Horstii, (*fig. 15*), should be mentioned. They dealt mainly with the story of the "golden tooth." As the story can be found in Guerini's history, it need only be mentioned here.

VIII. THE BOOK BY FRANCISCO MARTINEZ

The next attempt was an octavo volume of 304 pages by Francisco Martinez (1518-1588), published in 1557, at Valladolid, Spain. It is the earliest dental work relating to operative dentistry, being illustrated by a number of cuts of dental instruments, mainly those used for cleaning and extracting teeth. In it we find the earliest reference, in a dental book, to Saint Apollonia, the patron saint of dentistry, as well as her portrait. The title page characterizes the book as follows: "Brief and compendious colloquy on the structure of the denture and the wonderful construction of the mouth. With many remedies and necessary advice. Together with the mode of treating and beautifying the teeth. Addressed to the most high and powerful sire the Prince Don Carlos our lord. Composed by the Baccalaureate Francisco Martinez, native of the city of Castrillo de Oneilo, Valladolid, 1557. Con Privilegio. This is valued at LVII. Maradevis." The tendency of ancient authors to give the title pages of their works the character of an introductory paragraph is shown in this translation. Attention was first called to this work by Endelman (31) in 1903. (*Fig. 16.*)

This book represents a fair example of the dental knowledge in Spain and other countries during that century. It was written nine years before Eustachius' "Dental Histology," and gives us the conception held at that time relative to the structure of the teeth. It

endeavors to impress upon the reader that care and attention must be given to the teeth in order to keep and preserve them. It consists of 152 pages, octavo in size, and is divided into four parts. The

COLOQVIO BREVE Y
cõpẽdioſo. Sobre la materia đ la dẽ
tadura, y marauilloſa obra đ la bo
ca. Cõ muchos remedios y aui
ſos neceſſarios. Y la ordẽ
de curar, y adrecar
los dientes.

¶Dirigido, al muy alto y muy pode
roſo ſeñor: el Principe dõ Carlos nro ſe-
ñor. Cõpueſto por el Bachiller Fraciſco
Martinez. Natural dela villa de Caſtrillo
de onielo. Eſtãte en Valladolid. 1557.
Con preuilegio.
¶Eſta taſſado en L VII. mrs.

FIG. 16. Title page of the book by Francisco Martinez (1557). The oldest Spanish work on dentistry, and the first pertaining to prosthetic dentistry.

first part defines the teeth and the object for which nature created them. Part two, where the life of the teeth is divided into three periods. "The first period of his classification embraces the time

from the eruption of the deciduous teeth to that of their substitution by the permanent organs. The second, from the eruption of the permanent teeth to the time when they have reached their full development. The third period, beginning when they are presumed

FIG. 17. St. Apollonia, as figured on the last page of Martinez' book (1557)

to have attained complete development, runs to the time when they fall out from disease or other causes. In the *second division* Martinez recommends, in order to prevent decay of the deciduous teeth, that whenever little black spots appear upon the surfaces they should be removed by means of instruments, and that the spot should then

BARTHOLOMAEI
EVSTACHII
SANCTOSEVERINATIS
LIBELLVS DE
DENTIBVS.

Cum priuilegijs.

VENETIIS,
M D LXIII.

FIG. 18. Title page of the book by Eustachius, "Libellus de dentibus" (1563). The first Italian work, and also the first on dental anatomy and on the histology of the teeth.

be rubbed vigorously with a stick dipped in boiled wine to which some alum and common salt have been added. In this connection it is interesting to observe that the purpose he had in view, in advising that the deciduous teeth should be properly cared for, was not to benefit the child directly, but to retain the crowns so that when these teeth had to be extracted, an operation which he considered essential in order that the permanent teeth could erupt properly, extraction would not be rendered troublesome and difficult by the fragility of decayed crowns. In *part III* we find a dissertation on the four diseases which were supposed to affect the teeth during their third period of life. These diseases he classified as, first, the "Neguijon" (from *nigellus*, black), the condition familiar to us at present under the name of dental caries; second, "Corruption of the gums;" third, "Tartar;" and fourth, "Traumatisms." *Part IV* is devoted to a dissertation on the manner of preserving the denture.

The engraving representing Saint Apollonia differs from those usually reproduced and is found at the end of some editions. (*Fig. 17.*) The copy in the New York Hispanic Societie's Library does not contain this page, although as far as I can tell it is complete, while the one at the Thomas W. Evans Institute, in Philadelphia, does conclude with this illustration.

In the same year and city, as recorded in bibliographies, there was another Latin pamphlet, "De dentione," by Franciscus Martinus de Castrillo, probably the author of the preceding book. When it was first published I do not know, as I have not personally had the opportunity to see or examine a copy.

IX. THE BOOK BY BARTHOLOMAEUS EUSTACHIUS (1520-94): "LIBELLUS DE DENTIBUS"

This work was written in Rome and published in Venice in 1563. (*Fig. 18.*) Most bibliographies as well as Guerini's History, state that it is a little octavo volume of 95 pages. The two copies in my possession, one published separately in a paper cover, the other bound in leather with a number of his other works, have 6 introductory pages, 95 of text, 42 of annotations, and 2 of errata—a total of 149 pages, divided into thirty chapters. The separate copy has the annotations after the text. In the copy in the bound volume, the

RECHERCHE

DE LA VRAYE ANATHOMIE DES DENTS, NATVRE ET PROPRIETE DICELLES.

Où eſt amplement diſcouru de ce qu'elles ont plus que les autres Os: auecq' les Maladies qui leur aduiennent depuis noſtre Enfance, iuſques à l'extreme & derniere Vieilleſſe. Et les remedes à ſont propres, à l'un & l'autre Aage. Puis ſur la fin pour les conſeruer en ſanté, les reigles neceſſaires.

Le tout tiré des authorités d'Hippocras, Galien, & Ariſtote, confirmees des plus graues, anciens, & modernes Autheurs.

PAR VRBAIN HEMARD, CHIRVRgien de monſeigneur le Reuerendiſſime, & Illuſtriſſime Cardinal d'Armaignac. Et lieutenant pour les Chirurgiens en la Seneſchauſſee, & dioceſe de Rouergue.

1582.

A LYON,
PAR BENOIST RIGAVD.

1582.

FIG. 19. Title page of the book by Hemard (1582). The first dental work in French

annotations precede the title page, and are included in the annotations of Eustachius' other writings. In the dedication, Eustachius states "that he collected together all he could find of that which had been written concerning the teeth; to this he added the results of his own labors in diligent original research, not in the effort to establish some preconceived doctrines or ideas, but rather in the spirit of an impartial and upright judge accustomed to place in order and sift evidence in the effort to reach the truth." The annotations as well as the text are based upon the collective works of Hippocrates, Aristotle, Galen, and many other authorities. The title page, freely translated, reads: "Bartholomew Eustachius, his little book, wholly devoted to the teeth—with privileges. Venice MDLXIII."

In this monograph we find the first general treatise ever written on the anatomy of the teeth, and as recently as 1924 it was thought enough of to be translated into another language (32). Nearly all of the dental histories have considered this work in great detail, so it will not be necessary to go into greater length in this review.

X. THE BOOK BY URBAIN HEMARD (1548-1618): "RECHERCHE DE LA VRAYE ANATHOMIE DES DENTS"

This volume, written in 1581, was dedicated to Cardinal D'armignac of Roy, and published in Lyons, France. (*Fig. 19.*) It is a small octavo volume of 4 pages of dedication, 4 of introduction, 1 of a list of authors quoted, and 3 of poetry, followed by 90 pages of text, 2 of a list of the chapters, and 13 of contents—117 pages in all. The work itself, consisting of twenty-three chapters, considers thoroughly the question of the anatomy and the development of the teeth, and the various problems of dentition.

Fortunately I have been able to obtain and now possess a complete photostatic copy of this remarkable compilation of ancient authors. Though the work is not original in the true meaning of the word, I cannot agree with previous historians that it is not original. Hemard carefully examined the writings of about forty-two of the ancient authorities, especially their references to dentistry, and then wrote the book. Nevertheless, Guerini, on page 204 of his History of Dentistry, states: "As to what concerns the anatomy of the teeth, Hemard's book does not contain anything original. The following

passages, transcribed by Portal, show luminously that Urbain Hemard, instead of making researches of his own, has simply copied the Italian, Eustachius, translating the latter almost literally. The beauty of it is that Portal has not noticed the plagiarism in the least, since he says that if Urbain Hemard had taken into account the researches of Fallopius and Eustachius as well, his book would have acquired still greater value. But, in truth, he has taken into account, and has valued the researches of Eustachius so much as to palm them off, as his own." He then quotes two columns side by side from Eustachius and Hemard. The one of Hemard's was translated from Portal's "Historie de l'anatomie et de la chirurgie;" Paris, 1770.

I have carefully examined all three citations and cannot agree with Guerini. Eustachius, in Chapter XV, refers to Hippocrates as the source of the portion Guerini ascribes to Eustachius (p. 44-45). In his annotations, Eustachius again refers to Hippocrates, lib. de carnib. p. 58. uer. 18, for this information. Hemard, in two paragraphs preceding the quoted passages in Guerini, Chapter VIII, page 35, gave due credit to Hippocrates for this information. In his introduction Hemard states: "Ainsi que vous trouverez que ie m'y suis affectione, apres Phaloppe, Paré, Berthelemy Eustache & autres grand Anathomistes de nostre temps, pour accomplir ce persen discours des Dents, que i'ay anrichi de plus curieux & forts Arguments," etc. Hemard, like Eustachius, treasured what his predecessors had written on this subject, and showed that he applied himself to a close and serious study of their works. As this was the first dental work written in French, it certainly represents noteworthy progress in this field.

By the end of the sixteenth century no less than forty treatises, pertaining exclusively to the teeth, had been published. We thus see that up to the year of 1600, dental literature, having made a fair start in Germany, Spain, Italy, and France, was at the beginning of a long series of contributions that presented the results of original investigations of practical experiences and profound study. Earlier I stated that we owe a great deal to medicine for our foundation and literature. I believe the evidence so far presented certainly bears me out.

XI. THE BOOK BY BENJAMIN MARTIN

The next important French treatise was written, ninety-seven years after Hemard's, by Benjamin Martin, though we find five others during those intervening years. His "Dissertations sur les dents" bears the "approbation" July 19, 1679, and contained fourteen chapters, 136 pp. 14 l. 4°. (*Fig. 20.*) The contents show that this work was very extensive and thorough, and should be considered an original as well as a valuable contribution to dentistry.

Contents

Chapter 1: De la nature des Dents. De ce qu'elles different des autres os; & de leur sensibilite. Page 1
Chapter 2: Du temps, & de la maniere que les Dents naissent. De leur nombre, & des noms qu'on leur a donnez. Page 3
Chapter 3: Des maladies des Dents lors qu'elles naissens; & des moyens de les prevenir. Page 16
Chapter 4: Pourquoy les enfans naissent sans avoir des Dents; & pourquoy elles n'ont point de racines. Page 23
Chapter 5: De la chute des Dents dans l'enfance. De leur carie; & de ce qu'il faut observer pour eviter leur difformite. Page 27
Chapter 6: De la grande utilite des Dents, & a quelle fin elles nous ont este donnees. Page 41
Chapter 7: De la beaute & bonte des Dents. De leurs especes & difformite. Page 48
Chapter 8: De la maniere que l'on peut conserver les Dents, & le regime qu'on y doit tenir. Page 55
Chapter 9: De la duree des Dents. Page 80
Chapter 10: Des Maladies & des accidens qui paroissent dans le seconde dentition; & des remedes qu'on y doit apporter. Page 85
Chapter 11: Qu'il n'est pas toujours a propos de se faire tirer les Dentes quand on y sent de la douleur; Et de certaines erreurs populaires fur cette matiere. Page 105
Chapter 12: De la troisieme dentition. Page 112
Chapter 13: Des sencives, & de leurs accidens. Page 118
Chapter 14: Des perfections & difformitez des zencives. Page 129

A few contemporaries of Fauchard deserve mention: *Jourdain*, "Traite des maladies—de la bouche," Paris, 1778; *Geraudly*, Fr. A., "L'art de conserver les dents," Paris, 1737; *Bunon*, "Essai sur les

DISSERTATION

SUR LES

DENTS.

Par B. MARTIN.

A PARIS
Chez DENYS THIERRY, ruë Saint Jacques, à la Ville de Paris.

M. DC. LXXIX.
Avec Approbation & Permission.

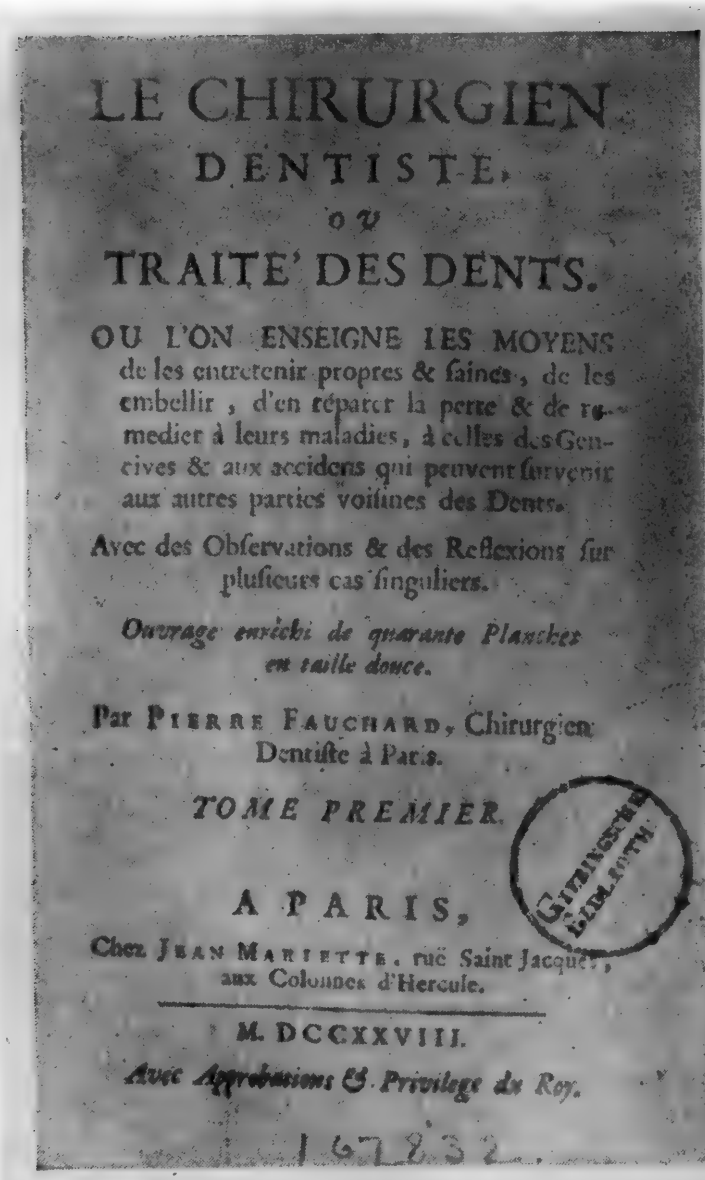
FIG. 20. Title page of the book by Benjamin Martin (1679)

maladies des dents," Paris, 1743; *Mouton*, "Essai d'odontotechnie," Paris, 1746; *Lecluse M.*, "Nouveaux elemens d'odontologie," Paris, 1754; *Bourdet*, "Recherches et observations . . . . du dentiste," 2 vol., Paris, 1757. Bourdet was a celebrated dentist and elegant writer "in whom the gifts of literary and scientific culture were coupled with a vast experience and a profound spirit of observation." He has to his credit six different books in various languages. *Garengeot*, "Nouveaux traité des instruments de chirurgie," Paris, 1727, is credited with being the "inventor" of the "Garengeot key," but the "pelican" he used was but an improvement of the one devised by Arculanus, and later by Paré. One of the earliest to use, and no doubt the "inventor" of, the "key" that bears Garengeot's name was Bourdet. It is illustrated and described in Vol. II, plate 9, p. 141.

XII. THE WORKS OF PIERRE FAUCHARD (1678–1761)

The progress that dentistry made in its scientific development up to the early part of the eighteenth century is best portrayed in the writings of Fauchard. For centuries it was in an embryonic condition, attaining the highest degree of development in France, until it there reached a point which entitled it to be considered a special branch of medical science. Out of sentiment or jealousy, the dentists before Fauchard's time refrained from publishing anything concerning their art. He was determined to break down this practice by publishing the results of all their studies and experiences, besides the technical details, theretofore closely guarded, which according to the idea of that time constituted the secrets of the profession.

Fauchard did not create the dental art, for, as he states, the greater part of the facts enumerated in his works were already known before his time, but were seldom mentioned in the writings of his predecessors. He did, however, make important contributions to this specialty, and credit must be accorded him for his inventions and improvements on the technical side. He placed dentistry on a scientific plane through collecting and incorporating in one book the entire doctrine of the dental art then known, theoretical as well as practical. Not only was Fauchard the first to advocate a broader education for dentists, but he also gave to dentistry its first scientific work. His "Le Chirurgien Dentiste" in two volumes, written in



LE CHIRURGIEN
DENTISTE,
OU
TRAITE' DES DENTS.

OU L'ON ENSEIGNE LES MOYENS de les entretenir propres & saines, de les embellir, d'en réparer la perte & de remedier à leurs maladies, à celles des Gencives & aux accidens qui peuvent survenir aux autres parties voisines des Dents.

Avec des Observations & des Reflexions sur plusieurs cas singuliers.

Ouvrage enrichi de quarante Planches en taille douce.

Par PIERRE FAUCHARD, Chirurgien Dentiste à Paris.

TOME PREMIER.

GIESSEN UNIVERSITÄTS BIBLIOTHEK

A PARIS,

Chez JEAN MARIETTE, rue Saint Jacques, aux Colonnes d'Hercule.

M. DCCXXVIII.

Avec Approbation & Privilege du Roy.

167832

FIG. 21. Title page of the first edition of Pierre Fauchard's work (1728). The first publication on scientific observations in dentistry.

1723 and published in 1728, was undoubtedly prepared with the idea of conveying all he knew about odontology, and in a manner that would be of greatest help and interest to those who succeeded him. It served its purpose so well, that it remained the authoritative work for over half a century. His treatise marks a distinct epoch in the progress of dentistry, and may truly be regarded as the first of dental publications in France during the eighteenth century. (*Fig. 21.*)

In 1733, the first edition was translated into German by Augustinius Buddaneuss. The second French edition was published in 1746, and contained the first accurate account of "pyorrhea;" the third was published in 1786, after Fauchard's death. All of these editions are now fortunately in my possession. The book was practically completed about 1723. Although carefully written, yet in order to make it as accurate as possible, Fauchard submitted the manuscript to medical friends for additions and corrections. To many, the writings and ideas of Fauchard would today be a revelation.

The original manuscript (first completed notes) of "Le Chirurgien Dentiste"

In 1924, through the courtesy and help of Mr. George Dagen, Editor of the *La Semaine Dentaire*, and Mr. Rene Odin, likewise connected with the above journal, an appointment was made with Dr. Han, Manager of the Library of the Medical School of Paris to see the original manuscript of this volume. At the time I hardly realized the privilege that was accorded to me, until Dr. Han, in the course of some preliminary remarks, stated that within his knowledge of many years in his connection with the Library, only two others outside of the staff had been permitted to see and examine this priceless manuscript, namely, Dr. Geo. Viau and Mr. Geo. Dagen, and that Mr. Odin and myself were the third and fourth. I cannot understand the psychology of a library that does not feature and show such an important volume. After he made the above remark, I feared to ask permission to photograph a few pages, although we were prepared to do so. Finally I took courage to ask if it would be possible to obtain photographs, and to my surprise he said: "Why certainly." While I held the manuscript, Mr. Odin made two illustrations (*figs. 22* and *23*) which clearly show what Dr. Viau has al-

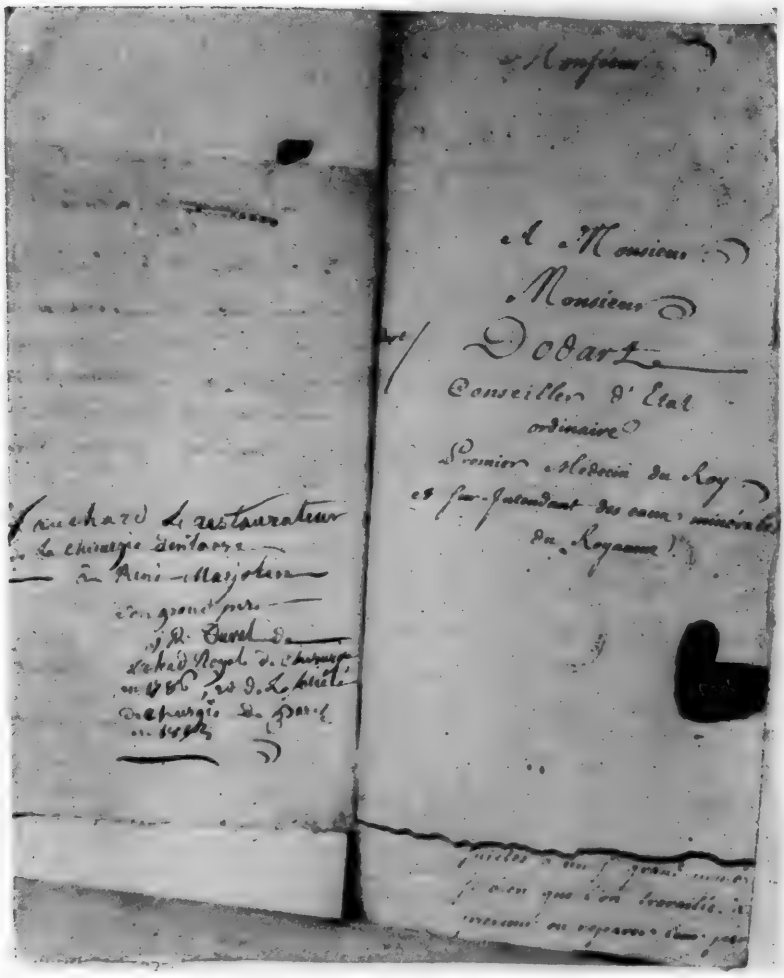


FIG. 22. A photograph of Fauchard's original manuscript; the first volume. The left side shows that this manuscript had been in the possession of J. R. Duval and presented to René Marjolin. The right side shows an inserted page in the middle—the opening part of the dedication. Underneath is the manuscript proper.

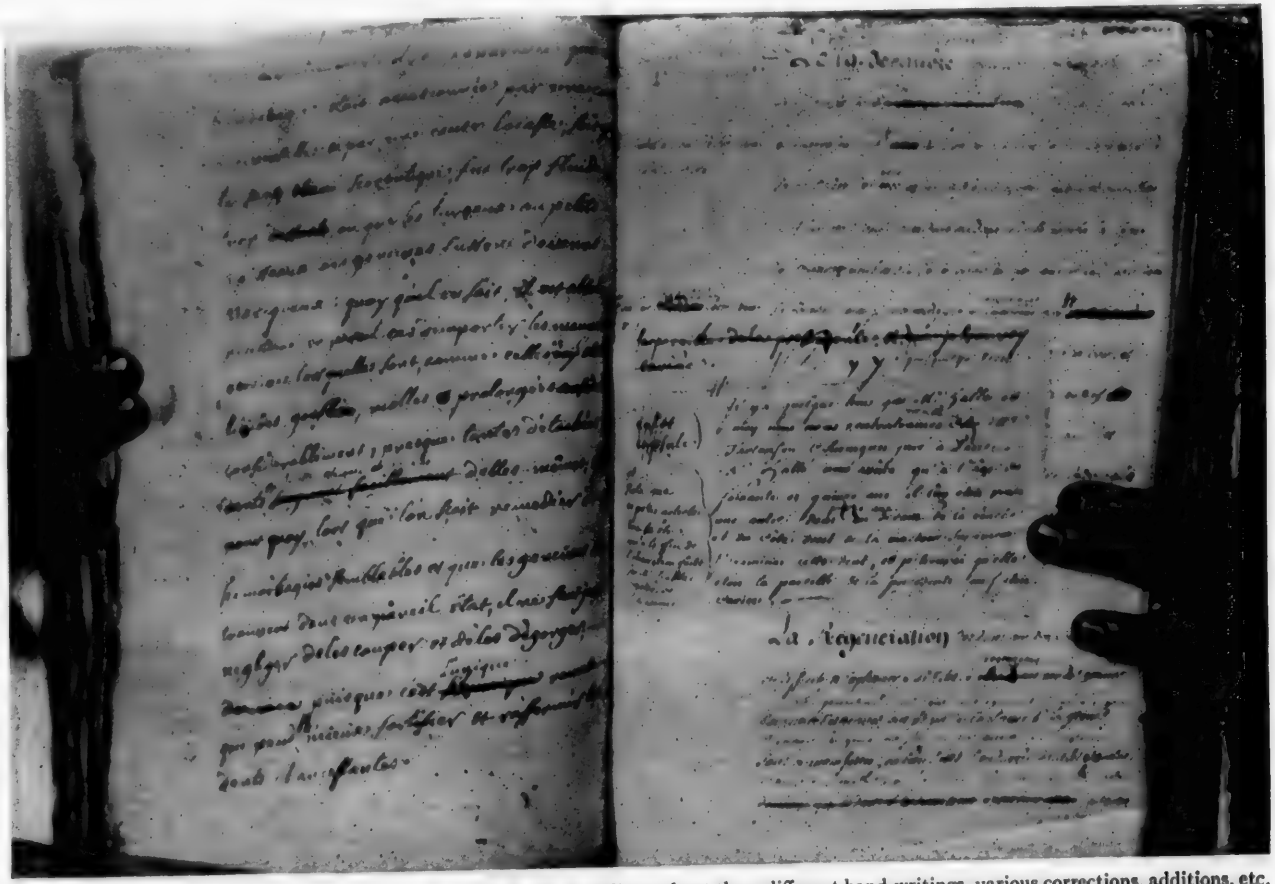


FIG. 23. Another portion of the manuscript shown in *fig. 22*, revealing at least three different hand-writings, various corrections, additions, etc.

ready described, and for the first time the dental profession may see what the original notes were like.

In the short time at our disposal to examine this manuscript a number of interesting facts were disclosed. The manuscript, which bears the number 2232 of the Medical School of Paris, is a large leather bound volume of over four hundred pages, 13 by $8\frac{3}{4}$ inches, or 32 cm. high by 22 cm. wide. It is in a remarkable stage of preservation, with the paper still white in color and the writing clear. Each page has a wide margin, full of notes, corrections and additions, while here and there are sheets or half-sheet inserts, with "observations" and further material. Both sides of the pages contain the text, and throughout the manuscript are various handwritings as already described by Viau. The handwriting that predominates is that of the copyist, in large, careful and legible script; the other two, and maybe more, are those of Fauchard himself, or one of his twenty "reviewers."

From Fauchard's "privilege of royalty" we learn that he completed his manuscript and had it registered and attested before the Register on February 28, 1723, but did not finish the manuscript proper until February 20, 1728. "Registre ensemble la cession sur le Registre VII de la Chambre Royal des Libraires, Imprimeurs de Paris, num 68, fol. 62 conformement aux anciens Reglemens confirmez par celui du 28 Fevrier 1723. A Paris le 20 Fevrier 1728 Brunet, Syndic." We thus perceive that exactly five years elapsed from the preparation of the original notes to the completion of the manuscript. However, on February 12, 1728, he gave permission to his publishers to print the work. "J'ai cede au Sieur Jean Mariette mon drort au present Privilege, pour en jouiir suivant l'accord fait entre nour. A Paris ce 12. Fevrier 1728. P. Fauchard."

Upon examining the manuscript, I found that it was but a part of the original edition, and consisted of only the first volume. This puzzled me a great deal, until after a study and an analysis of the photographed plates. My observations lead me to believe that this manuscript was that of his original writings and the part corrected by his medical friends. After five years, having been in the hands of twenty of his colleagues, it needed a revision and rearrangement of material so that it was necessary to recopy all of it, in order that

a printer could easily set it up in type. The second volume being Fauchard's own, and not having someone superior to him at the time in prosthetic knowledge, needed no revision, was used by his publisher as it was originally written. The revised copy of the first volume, as Fauchard originally wrote it, has not been found. Again, no illustrations are to be found in this manuscript, but references to these are everywhere. This copy of the original manuscript, which has turned out to be what Fauchard wrote plus corrections, alterations, erasures, and additional observations by his medical friends, was once in the possession of J. R. Duval and later presented by him to Rene Marjolin. *Fig. 22*, left hand side, shows memoranda in the handwriting of Duval, and is an interesting historical document. The inserted page, right hand side, is the opening part of the dedication. The handwriting is that of the copyist, the correction perhaps Fauchard's. In the original printed edition this insert appears at the top of the page, the "Monsieur," found at the top of the following page, being near the bottom of the printed page. One can faintly make out the bottom of this same sheet and is to be found on page b.ii, the last four lines. The inserted page has been corrected for copy as one can note by the "odart" opposite Dodarte, the end of the word in the manuscript appearing as an e, but evidently intended for a comma (,) as shown in the 1728 edition.

In *fig. 23* we find at least three different handwritings. The original page differs from the even, clear, legible writing shown in *fig. 22*. The chapter number is lost in the midst of additions, alterations, and corrections. Such notes are to be found throughout this manuscript. Even the margins at the top and sides are full of indecipherable writings. In the center, the darker portion is a half inserted page of observations. Fairly long pages of this kind are inserted here and there. This script is better than that found in the pages underneath, and might be by one of the collaborators. Again on the left side, we find still another writing, which is undoubtedly Fauchard's own. These two pages are good examples of the makeup of the manuscript and illustrate the care with which this work was prepared for publication. The care and fairness of Fauchard in preparing this work can be determined from his twenty-fourth chapter, vol. 2, in which he states that although he finished his book in 1723,

he learnt of a new work describing an instrument similar to his, and to avoid injustice to the other man, referring to Garengeot and his key, he desired first to see this instrument before publishing his book.

These illustrations were picked at random and clearly established the existence of various handwritings throughout the manuscript. This particular portion happens to be, left side, pages 283 and 284, vol. 1 of the 1728 edition, while the right side is pages 285 and 286. The first two pages are the "Reflexion" of Chapter 23, while the other, Chapter 24, are six observations of regeneration of the teeth. The additional notes surrounding chapter 24 are the title and substitutes, "First observation," etc. These observations were made and inserted into the original manuscript in December, 1723, nearly a year after the original writing of the text. "Le 19 December 1723," opens chapter 24 (chapter 25 in the second and third editions), page 285, and continues to the word, "La Regeneration." Following this is the small inserted page placed just before the "Reflexion" on page 286. This word is not visible in the illustration. "La Regeneration," etc., is also to be found on this same page, after the inserted material.

With all the care given this portion of the manuscript, in corrections and alterations, an error unfortunately crept in and was not noted until it had been printed, when a note at the end of this first volume was inserted to call attention to this mistake: Page 285, fourth line from bottom, "une canine de la marchoire inferieure." In subsequent editions the "inferieure" was altered to read "superieure," although the German translation failed to correct this error. Twelve such errors were found and noted in volume one, while volume two had ten.

The printed copy shows another error not noted in this particular copy of Fauchard's manuscript. On the inserted page, we find repeated references to a Mr. M. Zalle, as well as in the margin with no marginal correction. In the printed edition this name has been altered to read M. Halle. The portion in brackets along the left hand margin of *fig. 23* was not included in the text, and is merely a note calling to Fauchard's attention "M. Zalle (word not decipherable) de l'academie." Evidently a member of "L'Academie" of France. From this insert and notes, it seems probable that this portion was added by one of Fauchard's collaborators and found

sufficiently interesting to be included. It refers to M. Halle in his 75th year erupting another tooth.

Summary. These are but four pages of Fauchard's original notes of vol. 1 of his "Le Chirurgie Dentiste." Interesting as these have proved to be, there is no doubt that if the manuscript were gone over carefully and critically even more interesting and important data would be obtained, giving a clearer insight into Fauchard's ability, and eagerness for truth and knowledge, as well as revealing more fully his willingness to ask for information and suggestions, and embodying them in a work that he made a master piece.

We must thank Dr. Viau for his efforts in finding this manuscript, and for the study he has made of it. I trust that either he or Mr. Dagen will give it a future careful study and examination, and that we may learn more of the "Father of Dentistry."

XIII. THE BOOK BY CHARLES ALLEN

One of the most interesting and quaintest books in my library is a copy of the first dental work published in the English language, by Charles Allen in 1686. It is surprising and indeed a curious fact that none of the forty dental histories so far published, including Guerini's, discuss this work. Why all of the early English and French authors failed to refer to it is indeed a mystery to me, and that it should have remained latent for over two hundred years is even more astonishing. Although written 260 years ago, until my article upon this book appeared, in June 1924 (33), we had no definite knowledge of it or of its contents. Since then, as with all discoveries, an awakening seems to have occurred, and instead of my own being the only known copy, seven more have come to light. Thanks to the renewed interest aroused, and the interesting preface of Mrs. L. Lindsay, Librarian of the British Dental Association, in Reprint No. 1 of that Association, we have been able to determine more about this rare work, but unfortunately not about the author.

The first copy of Allen's work was entitled: "The Operator for the Teeth," etc., and was printed in Dublyn in the year of 1686 by Andrew Crook and Samuel Helsham. (*Fig. 24.*) Only one copy of the first edition is known to exist and it is in the Library of Trinity College, Dublin. In the next year, 1687, another edition, or rather a reprinted

THE

OPERATOR

For The

TEETH:

SHEWING

How to Preſerve the Teeth and Gums from all the Accidents they are ſubject to: With particular Directions for Childrens Teeth.

As alſo the Deſcription and Uſe of the *POLICAN*, Never Publiſhed before.

By *CHARLES ALLEN*, Profeſſor of the ſame.

To which is Annexed

A Phyſical Diſcourſe, wherein the reaſons of the Beating of the *Pulſe*, or *Pulſation* of the *Arteries*, together with thoſe of the circulation of the *Blood*, are mechanically Explained; which was never done before.

By an Unknown Hand.

DUBLIN, Printed by *Andrew Crook* and *Samuel Helſham* for the Author, and are to be Sold by *Robert Thornton* Bookſeller, at the *Leather-Bottel* in *Skinner-Row*, and by the Author at his own Lodging at Mr. *Bauiſter*'s at the *Smiths-Arms* in *Eſſex-ſtreet*.

FIG. 24. Title page of the book by Charles Allen (1686). The first English book on dentistry; published in Dublin.

CURIOUS

OBSERVATIONS

In that difficult part of

CHIRURGERY,

Relating to the

TEETH

SHEWING,

How to Preſerve the Teeth and Gums from all Accidents they are ſubject to.

AS,

1. An Account of their Nature. 2. Their Alteration, with their proper Remedies. 3. Their Cauſe of Corruption and Putrefaction. 4. Directions for reſtoring or ſupplying the defect of them in old or young. 5. Conſiderations on the Tooth-Ache, Looſeneſs of the Teeth, the decay of the Gums, with their Remedies and Reſtoratives. 6. The uſe of the POLICAN or Inſtrument wherewith, they are drawn on all Occaſions. Laſtly, Teeth in Children, what they are in the Original, and how they come to Perfection, in what order produced, the means to haſten them, and render them eaſie in breeding.

To which is added,

A Phyſical Diſcourſe, wherein the Reaſons of the beating of the Pulſe, or Pulſation of the Arteries, together with thoſe of the Circulation of the Blood are explained, and the Opinions of ſeveral Ancient and Modern Phyſicians and Philoſophers, as *Gallen*, *Gaſſendus*, *Carteſius*, *Lower*, *Willis*, &c. Upon this Subject are examined.

DUBLYN, Printed and are to be ſold in *London*, by *William Whitwood* in *Duck-Lane*, 1687.

FIG. 25. Title page of the reprinted edition of Allen's book; published in London in 1687.

edition was published in London, by William Whitwood. (*Fig. 25.*) The only difference between the two editions is the change in the title, the second being: "Curious Observations in That Difficult Part of Chirurgery, Relating to the Teeth. Showing, How to Preserve the Teeth and Gums from All Accidents They are Subject to."

A. History

Although Carabelli (34), in his excellent survey of dental history (1844), fails to say anything of this book, in his bibliography, page 159, he records it as follows: "Curious observations on that part of chirurgery relating to the teeth, 4° London." The same is true of Linderer (35), for in the history (1851) he also neglects to mention this work, but records it on page 442, as did Carabelli. Besides Linderer, the only other bibliographies that contain this item are Coles (36), Crowley (37), Sternfeld (38), Port (39), and Greve (40). In 1883, Coles neglected to mention the book, but on page six of his list of works on dentistry he heads the English section: "No Name, Curious Observations on that Part of Chirurgery relating to the Teeth, London." In 1885, Crowley, on page ten strangely gives Allen credit for the work: "No. 1509, Operator for the Teeth, Dublyn, 1687;" and the second item in the English section, "No. 1510, Curious observations on that part of chirurgery relating to the teeth, London, 1687," he credits, on page 180, to an anonymous author. In 1891, Sternfeld happened to give the author's name correctly, but the title incorrectly. He stated that he obtained this information from Crowley, but failed to note that No. 1510 was by an anonymous author, as all other bibliographers have so far done. In fact, it appears that all who have compiled their bibliographies copied them from Carabelli and later from Crowley. The errors in the name, title, or place of publication have never been corrected. The correct title of the first edition is the "The Operator for the Teeth, shewing how to Preserve the Teeth and Gums from all Accidents," etc., Dublin 1686. The title of the second edition is "Curious Observations in (and not on) That Difficult (which fails to appear in any of the titles) Part of Chirurgery Relating to the Teeth, Shewing How to Preserve the Teeth and Gums from all Accidents they are subject to," etc., written in Dublyn, 1687 and published in London.

It seems odd that none of the early English authors who followed Allen, among them Hurlock (41), Berdmore (42), Ruspini (43), Blake (44), Hunter (45), and Fox (46), mentioned the first dental work in English or referred to Allen. Even in those days this work must have been extremely rare. Ashley Densham (47), in his remarkable review of the progress of dental science, the best of the recent English historical dissertations, and all medical historians, have overlooked this important work. Of course, one must not lose sight of the fact that Allen's book was written thirty-six years prior to Fauchard, fifty-five years before Hurlock, eighty-one years before Berdmore and Ruspini, eighty-four years before Hunter, and one hundred and sixteen years before Fox.

B. Contents

This work of 58 pages and contents is 19 cm. long and 14 cm. wide. The first 43 pages are devoted to an account of the teeth, while the forty-fourth page is an advertisement, concerning which more will be said a little later. Pages 45 to 57 treat of the second part relating to the pulse, as shown at the bottom of the illustration. Both the Dublin and London editions consist of 58 pages and 1 leaf. The first edition is a trifle larger than the reprinted edition, which is 19 cm. long by 14 cm. wide. The first 43 pages are devoted to an account of the teeth, while the forty-fourth page is an advertisement.

From his introduction in the "Proem" we are led to assume that he also was the first English dental practitioner, for he states "Of what importance it is to all men to be informed of those benefits which by MY ART they may enjoy;" also, in Sect. 1: "And therefore being about to treat of MY ART." As today our keynote is prevention, so we also learn from Allen that such was the case nearly two and a half centuries ago: "Of what utility this undertaking of mine may be to every body, will appear by the sequel of this discourse, whereof the scope is to prevent the loss of TEETH.—In a word the want of them, is as great a deformity, and of as much prejudice to one, as anything whatsoever can be.

The book opens with the following:

The Epistle Dedicatory to the most honourable and truly learned the physicians, chirurgions and apothecaries of the City of Dublyn.

Gentlemen,

When I see your INDEFATIGABLE Care in procuring men (than without which all the world is nothing) HEALTH, the PRIMARY cause, sole foundation and Prop of Humane FELICITY; and how the experience of so many years manifests to all men, by the happy success of your Undertakings, and your great Charity to the Poor, that your private intentions do correspond admirably well with your external actions; and that all your indeavours are real and unfeigned; I am perswaded, that whatever can in any wise contribute to the promoting of your most Noble and Generous Design, can't but be acceptable to you. Wherefore having with the same passion, for the publick Advantage, composed the following small Treatise, I take the liberty most humbly to present to You; that (as You are the best JUDGES of the thing) so You may be your Judicious and Impartial Censure of it, inform the world of its worth; that no person may be deceiv'd in it. For my intentions in publishing it, being to advance the common Good; if I thought it did contain anything contrary to that DESIGN, I shou'd be the first that wou'd indeavour its suppression.

But, GENTLEMEN, besides the foregoing reasons, which I had of offering You this first Essay of mine, I did it also to acquit myself in some measure of my Duty towards You; and to assure You further, that I am in all respects,

GENTLEMEN,
Your Most Humble, Most Obedient,
And Most Obliged Servant,
CHARLES ALLEN.

The book closes with the following contents:

Section I. Of the Nature of the Teeth.....Page 7
Section II. Of the Alteration of the Teeth.....11
Section III. Of the Corruption of the Teeth, with their Remedies..... 15
The Description and Use of the Polican..... 17
Section IV. Of the Restauration of the Teeth..... 19
Section V. Of the Tooth-ake, Looseness of the Teeth, and decay of the Gums, with their Remedies..... 22
Section VI. Of Childrens Teeth..... 37
Advertisement to the Readers..... 44
A Physical Discourse concerning the Beating of the Pulse, and Circulation of the Bloud..... 45
The Explication..... 52

Allen's idea in writing this work is expressed in the proem, and may we not infer from it that here might be found the first reference to a dental practitioner.

C. The proem

Knowing that it is the duty of every man, and especially of such as live in a Civil Government, (where the general interest always includes the particular) to contribute as much as he can (in his own station) to the publick Good and also of what Importance it is to all men to be informed of those Benefits which by my Art they may enjoy; I am resolved to set down here what I think most convenient for every one to understand concerning the preservation, and melioration of his own Teeth; a thing, indeed of little esteem among most people, but in truth, of inestimable value for its many and important consequences. However, in so doing, I shall acquit my self of my duty towards God and Man; and provided my indeavors prove but beneficial to others, (as certainly they will, if put in practice) it is all I desire, caring very little what opinion the Criticks of Words and artificial Logick may have of me.

Of what Utility this Undertaking of mine may be to everybody, will appear by the sequel of this Discourse; whereof the scope is to prevent the loss of Teeth; the use of which is so necessary in the preparing of food, that the want of such a help (if not supplied by strong dissolvents) hinders a true concoction of the Ailments in the Stomach; whence do proceed Indigestions, and abundance of Crudities very noxious to the body of man; as being the seed of most of those innumerable Diseases and Infirmities, whereby life is not only made troublesome to us, but also considerably shorter than it would otherwise be, which is so consonant to truth, that vulgar observation itself has turned it into common Proverb: For they use to say of one whose Teeth are naturally thin, that he is short-liv'd, whereof the reason is, that such persons do not chew their meat well. Moreover, the loss of Teeth renders the pronounciation both troublesome to ones self, and unintelligible to others. In a word, the corruption, and want of them, is as great a deformity, and of as much prejudice to one, as anything whatsoever can be.

D. Suggestion That This Is The First Dental Publication in English

In the "Epistle Dedicatory" already mentioned, I have called attention to the fact that Allen therein states, on page 4: "which I

had of offering you this first Essay of mine." He further confirms this on page 44:

Advertisement to the Readers

Gentlemen,

Although I have offered nothing in this Paper, but what is according to my own Experience, and the best of my knowledge; yet I will not say but that I have been deficient in many things, and have committed a great many Errors in the management of my Subject; but if you consider that I am the first (as far as I know) that ever wrote any thing of this nature; and withal, what is to be expected from one in my Circumstances, I hope you will be the more ready to excuse my faults. However, if what I have done be acceptable to you, I intend in a second Impression of this small Treatise to Correct, Illustrate, and augment it, to its fullest proportion. In the meanwhile I would advise you, to make use of what is here presented you, by

Your very Humble Servant,
CHARLES ALLEN.

Having already in another article (48) given Allen's treatise in detail, I will omit it in this paper.

XIV. SUBSEQUENT EARLY ENGLISH PUBLICATIONS

Nearly a half century elapsed after Allen's book before there was a true beginning of England's dental literature. The first recorded work is that of Joseph Hurlock: "A practical treatise upon dentition or the breeding of teeth in children." This consists of 285 pages, and gives excellent advice and important information to mothers, nurses, and those who have the care of young children. The next in order of publication were these:

Davis, Lockyer. A treatise on the teeth. 8q. London, 1752.
Tolver, A. A treatise on the teeth. 8q. London, 1752.
Hoffman, Frederick. A treatise on the teeth; their disorders and cure. Translated from the Latin. 8q. London, 1753.
Berdmore, Thos. A treatise on the disorders and deformities of the teeth and gums. 8q. London, 1768.
Berdmore, Thos. A treatise on the disorders and deformities of the teeth and gums. 12q. Dublin, 1769.

Berdmore, Thos. A treatise on the disorders and deformities of the teeth and gums, explaining the most rational methods of treating their diseases. Illustrated with cases and experiments. 12q. London, 1770.

A

TREATISE

ON THE

DISORDERS AND DEFORMITIES

OF THE

TEETH AND GUMS,

EXPLAINING

The moſt rational Methods of treating their Diſeaſes.

Illuſtrated with Caſes and Experiments.

By THOMAS BERDMORE,

Member of the Surgeons Company, and Dentiſt in Ordinary to his Majeſty.

A NEW EDITION WITH ADDITIONS.

Dente quid horridius nigro, quid pulchrius albo?

LONDON:

Printed for the AUTHOR.

Sold by BENJAMIN WHITE in *Fleet-Street*;

JAMES DODSLEY in *Pall-Mall*;

And BECKET and DE HONDT in the *Strand*.

MDCCLXX.

FIG. 26. Title page of the book by Thomas Berdmore (1770)

Ruspini, B. A treatise on the teeth, their structure, and various diseases. To which is added the most effectual method of treating the disorders of the teeth, established by a long practice. 8q. London, 1768; 1774.

Curtis, R. A. A treatise on the structure and formation of the teeth and other parts connected with them, together with the several disorders to which they are subject, and an inquiry into the most probable method of preserving them sound to an advanced age. 12q. Oxford, 1769.

Timaeus. A treatise on the toothache. 8q. London, 1769.

XV. THE BOOK BY THOMAS BERDMORE

The most important of the above were the editions of Berdmore (*Fig. 26*). He was the first to attempt to cover the field of dentistry, and the 278 pages of his work give a great deal of useful information, as shown by the table of contents.

A. Table of contents

Part 1

Chapter 1:	Design of this Treatise	Page 1
Chapter 2:	Method of this Treatise	Page 6
Chapter 3:	Anatomy and Physiology of the Teeth and Parts adjecent	Page 9
Chapter 4:	The Formation, Growth, and Shedding of the Teeth	Page 21

Part 2

Chapter 1:	Of diseases of the Teeth and Gums	Page 28
	Of the Tooth-ach, and its various Causes	Page 29
Chapter 2:	Of Defluxions falling on the Gums, and the Tooth-ach arising therefrom	Page 35
	Errors of the common Practice in this Disorder	Page 39
	The rational Methods of Cure	Page 40
	A Case	Page 43
Chapter 3:	Of Obstruction and Inflammation of the Nerves and vascular Parts of the Teeth, and the Tooth-ach arising therefrom	Page 47
	Methods of Palliation and Cure	Page 48
	Of Burning the Ear, Loadstones, Charms, &c.	Page 49
Chapter 4:	Of Acrid Matter generated in the Neighbourhood of the Teeth, and the Tooth-ach arising therefrom	Page 52
	The Cure	Page 53
	A Case	Page 54

Chapter 5:	Of Fungi, Excrescences and Ulcers of the Gums, and the Tooth-ach arising therefrom	Page 58
	A Case	Page 61
Chapter 6:	Recess of the Gums, Exposure of the Roots of the Teeth, and the Tooth-ach arising therefrom	Page 64
	The Cure	Page 66
	A Case	Page 69
Chapter 7:	Of Tartar of the Teeth, and the Recess of the Gums, and Tooth-ach occasioned by Tartarous Concretions long neglected.	Page 73
	Theory of the Formation of Tartar	Page 74
	Destructive Effects of Tartar	Page 75
	The Cure	Page 76
	Discoloured Enamel often mistaken for Tartar	Page 79
	The dangerous Tendency of the common Practice on this Occasion	Page ib.
	The Quick Generation of Tartar is constitutional	Page 80
	A Case	Page 81
Chapter 8:	Of Looseness of the Teeth, Change of Position, Protrusion, total Luxation, and the Tooth-ach arising from these causes.	Page 84
	Of the Re-placing of Teeth	Page 96
	The extravagant Promises of advertising Operators considered.	Page 99
Chapter 9:	Of Fractures of the Alveolary Part of the Jaw-bones, of sharp Splinters, of Portions of the Roots left behind in Extraction, of Bruises, and Lacerations of the Gums, and the Tooth-ach arising from these Causes	Page 104
	The affected Dexterity of Operators, and their Instruments considered	Page 105
	The extractions of Stumps not difficult as is usually imagined	Page 111
	How to stop the violent Haemorrhage which sometimes follows a Fracture of the Jaw-bone	Page 113
	The Symptoms and Treatment of a Fracture exemplified in a Case	Page 114
	Of Splinters raised in Extraction	Page 118
	A Case	Page 119

Chapter 10: Of the Tooth-ach occasioned by excessive cold Air, and the sudden Alternations of hot and cold Liquors Page 121
Chapter 11: Of the Sympathetic Toothach Page 123
Chapter 12: Of Matter collected in the Maxillary Sinusses, and sometimes in the cancellated Substance of the Lower Jaw, and the Tooth-ach arising therefrom Page 127
A Case Page 130
Another Page 133
Chapter 13: Of a Caries and Exostosis of the Bones which form the sockets Page 138
The Fallacy of pretending to cure every Tooth-ach by external Applications and Nostrums Page 142
A Case Page 144
Chapter 14: A Caries of the Teeth, and the Tooth-ach arising therefrom Page 147
Distinction of the various Sorts of Caries Page 148
Various Treatment Page 150
Of the Engrafting of a new Crown to the old Root Page 155
The Communication of Caries Page 158
Chapter 15: Of the Loss of Enamel, and the Tooth-ach arising from thence Page 160
Chapter 16: Of Fractures of the Teeth, and the Tooth-ach from thence Page 162
A Case Page 164
Chapter 17: Of the Tooth-ach, and the other Disorders arising from the last Dentition Page 168
Caution in cutting the Gum Page 170
Chapter 18: Of the Tooth-edge Page 172
Chapter 19: Of the Intermittent, or Aguish Tooth-ach Page 175
Errors of the common Theory and Practice Page 176
A Case Page 178
Chapter 20: Of Soreness, Softness, and Bleeding of the Gums, of supposed Worms of the Teeth, of stinking Breath, and soft Palate, and the curative Treatment Page 183

Part 3

Chapter 1:	Of the Care and Treatment of the Teeth and Gums, to prevent Diseases and Deformities of them, and to restore and preserve their beauty	Page 188
Chapter 2:	Of the First Dentition	Page 192
	The Importance of it, and how far the Treatment of it concerns the Health and Beauty of the succeeding Teeth	Page 193
	Of cutting the Gums of Children	Page 195
	The Custom of giving hard Bodies to be chewed on by Children considered	Page 196
Chapter 3:	The Care and Treatment of the Second Dentition	Page 199
	Of supernumerary Teeth, and double Rows	Page 201
	Causes of snaggled, rough, and indented teeth	Page 202
	Prevention of these Deformities	Page 203
	Cautions in the Extraction of Milk-Teeth	Page 205
	Failure of Success generally owing to the Timidity and Delays of the Artist	Page 207
Chapter 4:	Of Irregularities of the Teeth, and the Reduction of them by Ligatures	Page 212
	The extravagant Promises of certain Operators exposed	Page 213
Chapter 5:	Of the Use and Abuse of Filing, to remove Irregularities of the Teeth	Page 219
Chapter 6:	The Methods of preserving the Whiteness and Polish of the Teeth	Page 226
	Of Tooth-Powders, their Composition explained their pernicious Effects, as generally used, proved by Experiments and Computation	Page 228
	Action of Brushes and Cloths, for cleaning the Teeth, compared	Page 232
	Cases where Tooth-powders may be used	Page 233
	Of Tinctures for whitening the Teeth	Page 236
	Their Composition; their destructive Action proved by Experiments and Observations	Page 236
Chapter 6:	Rational and safe Method of Preserving the Beauty of the Teeth	Page 260

	Objections against brushing the Teeth answered	Page 261
	Of Testaceous Powders	Page 262
	Arguments against cleaning the Teeth, by means of Instruments, confuted	Page 264
Chapter 7:	Of vegetable Acids, Sweet-meats, violent Efforts picking the Teeth, Smoking, &c.	Page 266
Chapter 8:	Of the Care and Treatment of the Teeth in Old Age, and of artificial Teeth and Gums	Page 273
	Objections against artificial Teeth	Page 274
	Are owing to the Fault of the Artist, or the Negligence of the Patient	Page 276
	The Use and Construction of artificial Gums	Page 279

Berdmore's preface gives us a good idea of the state of dental education at that period.

B. Preface

"When first I resolved to devote my whole time and attention to that part of Surgery which concerns the Dentist's art; I observed, with regret, that no material instructions were to be derived from the writers of this country who have touched on the subject; therefore I endeavoured, for my own improvement, to collect carefully from my predecessors in business, and from practice, whatever I thought conductive to the advancement of it.

"After a few years thus employed, I found, or I thought I had found, my observations and discoveries in some measure worthy of being communicated to those who practice in this business, to the parents who are solicitous for the health and beauty of their children, and to the patients who are affected with disorders or deformities of the Teeth. I therefore endeavoured to reduce them to some order, and at last resolved to commit them to the press.

"The work being originally designed for artists, who are not much given to reading, and for patients who do not love too much trouble, I purposely avoided quotations. Indeed, without departing from subject, I could only have quoted a few French authors, who have written to make their names known, and one or two English, who have translated very injudiciously."

That Berdmore's book filled a recognized vacancy in the dental literature is shown by the five editions between 1768 and 1777: Dublin, 1768, 69; London, 1770; Amsterdam, 1769; Altenberg, Germany, 1777. In 1844, the *American Journal and Library of Dental Science*

THE

NATURAL HISTORY

OF THE

HUMAN TEETH:

EXPLAINING THEIR

STRUCTURE, USE, FORMATION,

GROWTH, AND DISEASES.

ILLUSTRATED WITH COPPER-PLATES.

By JOHN HUNTER, F.R.S.

SURGEON EXTRAORDINARY TO THE KING, AND FELLOW OF THE ROYAL SOCIETY.

LONDON,

Printed for J. JOHNSON, N° 72, St. Paul's Church-yard.

MDCCLXXVIII.

FIG. 27. Title page of the book by John Hunter. Although printed in 1778 it was not issued as a copy of the first or second edition; see *fig. 28*. No other copy known.

THE

NATURAL HISTORY

OF THE

HUMAN TEETH:

EXPLAINING THEIR

STRUCTURE, USE, FORMATION,

GROWTH, AND DISEASES.

ILLUSTRATED WITH COPPER-PLATES.

By JOHN HUNTER,

Surgeon Extraordinary to the KING, and Fellow of the ROYAL SOCIETY.

THE SECOND EDITION.

LONDON,

Printed for J. JOHNSON, N°. 72, St. Paul's Church-Yard.

MDCCLXXVIII.

FIG. 28. Title page of John Hunter's second edition; published in 1778. See *fig.* 27

republished it in Baltimore. Berdmore's teachings had an important influence upon American dentistry as one of his pupils, Robert Woofendale, practiced in this city for several years being one of the first dental practitioners in this country.

XVI. THE BOOK BY JOHN HUNTER: THE NATURAL HISTORY OT THE TEETH

Undoubtedly the most important book of that period, and the one that had the greatest and most far reaching influence upon dental literature, was John Hunter's "The Natural History of the Human Teeth, etc." London 1771. 128 pp. 16 copper plates 4 l. 4°. It was the fruit of many years oi careful study and research, and placed this phase of dentistry upon a scientific basis. With the next edition, Hunter added a second part: "A Practical Treatise on the Diseases of the Teeth," 128 pp., 4 l. 4°. The same, Dordraci (Dutch Trañslation), 1773, 213 pp. The same, Hagae, 1775. At the New York Academy of Medicine we have an edition that is not recorded in any bibliography. It is dated 1778, without the imprint "second edition," and contains both parts of the work. The type of the title page and introductory pages differs from that of the 1771 and the 1778 second editions, as does also the arrangement throughout, and the copper plates. (*Fig. 27.*) The same; second edition London 1778, 2 pts. 128 pp. 41, 16 copper plates, 4°. (*Fig. 28.*) The same; translated into Latin and Dutch by Pieter Boddaert, Dortrecht, 1773-80, 214 pp. 12 l, 66 pp., 4°. The second part, 1780, is only in Dutch. The same; German edition, Leipzig 1780. 296 pp. 8 pl. The same; Gravenhage, 1780. The same; third edition, London 1803. The same; Milano, 1815. The same; London, 1835, 37, by James Palmer 8°. The same; Philadelphia, 1839, by Thomas Bell. The same; New York, by Eleazar Parmly, 1839, 8°. The same; Paris, by G. Richelot, 1839-43, 143 pp. 8°. "Essay and Observations in Natural History, Physiology, Anatomy and Geology." 2 vol. (posthumous paper) Edited by Richard Owen, London 1861, 403 pp. 507 pp. 8°.

To this series belongs the first of that period, written by a dentist and teacher of dentistry, "The Natural History of the Human Teeth," by Joseph Fox. (*Fig. 29.*) This work served as a text-book for many years, and included a method of treating irregularities of the teeth, the changes that took place during second dentition. This

THE

NATURAL HISTORY

OF THE

HUMAN TEETH,

INCLUDING

A PARTICULAR ELUCIDATION OF THE CHANGES

WHICH TAKE PLACE DURING

THE SECOND DENTITION,

AND DESCRIBING THE

PROPER MODE OF TREATMENT TO PREVENT IRREGULARITIES OF THE TEETH.

TO WHICH IS ADDED,

AN ACCOUNT OF THE DISEASES WHICH AFFECT CHILDREN DURING THE FIRST DENTITION.

Illustrated with thirteen Copper-Plates.

BY JOSEPH FOX,

MEMBER OF THE ROYAL COLLEGE OF SURGEONS, LONDON;
AND OF THE SOCIETY OF MEDICINE, PARIS.

LONDON:

PRINTED FOR THOMAS COX, (AT HIS MEDICAL LIBRARY,) St. Thomas's-Street, Borough;
and sold by J. Johnson, St. Paul's Church-Yard; Messrs. Longman and Rees, and
Messrs. Robinsons, Paternoster-Row; John Murray, 32, Fleet-Street;
J. & A. Arch, Lombard-Street; S. Highley, 24, Fleet-Street;
J. Callow, Crown-Court, Soho; W. Creech,
Edinburgh; and Gilbert, Dublin.

1803.

FIG. 29. Title page of the book by Joseph Fox. The first text-book written by a dentist in England (1803).

was supplemented in 1806, by his "History and Treatment of Diseases of the Teeth and Gums and Alveolar Process." Fox began to lecture at Guy's Hospital in London in 1799 and the two volumes were the result of these lectures.

XVII. THE FIRST BOOKS BY EARLY AMERICAN PRACTITIONERS IN AMERICA

During the last decade of the eighteenth century there were many practitioners in this country, but two were probably better known than the others practicing here, in Boston, in Connecticut and in Philadelphia, namely, Robert Woofendale and Richard C. Skinner.

A. By Robert Woofendale

Robert Woofendale, after leaving England and with the knowledge he obtained from Thomas Berdmore, settled in New York City in 1766, remaining there until March 1768 and then returned to Liverpool. In 1783 he published a small volume entitled "Practical Observations in the Human Teeth." (*Fig. 30.*) This work should undoubtedly be included as part of America's contribution to our literature and the first published by a practitioner in this country.

B. By Richard C. Skinner

In Germany, we have already seen, the first and exclusive contribution to dental literature was written for the laity and not for the profession. In this country our literature had a similar beginning. In 1801, Richard C. Skinner, in his preface to "A Treatise on the Human Teeth," (*fig. 31*), states that "whatever are the merits or defect of this little production, the importance of the subject treated of, as respect every individual, it is presumed will not be denied, ... it is put into the hands of the public, for the inconsiderable sum of thirty cents." The work consisted of only 26 pages and is divided into the following subjects:

After the preface, a page of advertisements,
Page 6: Of the structure of the teeth.
Page 9: Eruption of the teeth.
Page 11: Disorders of the teeth and general causes of decay.
Page 12: Of the caries, or decay of the teeth.
Page 14: Of the alveoli, or sockets.

PRACTICAL OBSERVATIONS ON THE HUMAN TEETH.

By R. WOOFFENDALE,
Surgeon-Dentist, Liverpool.

LONDON,
Printed for J. Johnson, N°. 72, St. Paul's Church-Yard,
and Messrs. Richardson and Urquhart, Cornhill.
MDCCLXXXIII.

Fig. 30. Title page of the book by Robert Wooffendale (1783). The first work by a dental practitioner in America; written upon his return to London.

A

TREATISE

ON THE

HUMAN TEETH,

CONCISELY EXPLAINING THEIR STRUCTURE

AND CAUSE OF

DISEASE AND DECAY:

To which is added,

THE MOST BENEFICIAL AND EFFECTUAL METHOD OF TREATING ALL DISORDERS INCIDENTAL TO THE TEETH AND GUMS; WITH DIRECTIONS FOR THEIR JUDICIOUS EXTRACTION, AND PROPER MODE OF PRESERVATION: INTERSPERSED WITH OBSERVATIONS INTERESTING TO, AND WORTHY THE ATTENTION OF EVERY INDIVIDUAL.

By R. C. SKINNER,
Surgeon Dentist.

NEW-YORK:
Printed by JOHNSON & STRYKER, *No.* 29 *Cold Street,*
FOR THE AUTHOR.

1801.
Copy-Right secured.

FIG. 31. Title page of the book by Richard C. Skinner (1801). The first dental work printed in America.

TREATISE

ON

DENTISTRY

EXPLAINING THE

DISEASES

OF THE

TEETH AND GUMS,

WITH THE MOST EFFECTUAL MEANS OF PRE-
VENTION AND REMEDY:

TO WHICH IS ADDED,

DENTITION;

WITH RULES TO BE OBSERVED DURING THAT INTERESTING PERIOD.

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ACADEMY OF MEDICINE.

By B. T. LONGBOTHOM, SURGEON DENTIST.

BALTIMORE:

PRINTED BY PRENTISS AND COLE.

1802.

FIG. 32. Title page of the book by B. T. Longbothom (1802). The second dental work printed in America.

Page 15: Of the scurvy in the gums.
Page 16: Of abscess in the sockets or gum.
Page 17: Of the tartar and septic acid.
Page 19: Directions for extracting teeth.
Pages 22 and 23: Certificates.
Pages 24 and 25: Established fees.
Page 26: His advertisement of dentifrices. June 20, 1801.

XVIII. THE BOOK BY B. T. LONGBOTHOM

The following year a more elaborate "Treatise on Dentistry, explaining the Diseases of the Teeth and Gums," was written by B. T. Longbothom and published in Baltimore, in 1802, and perhaps should be considered the beginning of professional dental literature in America. (*Fig. 32.*) Though also written for the public, it consisted of 3 pages of preface, 4 of index, 58 pages of text, and 1 of errata—in all, 80 pages. The preface gives us a very good idea of the state of dentistry in America at that period.

"To Point out an art useful to society, is a duty incumbent on every individual capable of so doing; and the only excuse probably for its omission is when the misgiving mind imbibes a fear, that it may be imputed solely to a motive of self-interest. Under such an idea, nothing can tend more to reconcile to us the bringing of it forward, than a persuasion that we can convince the public, the advantage derived therefrom, (if not wholly theirs) are at least reciprocal; in this point of view, if we succeed, every unpleasant sensation is removed.—Impressed with such a hope, have I undertaken the following Treatise; not that I am ambitious of being crowned by the applause of successful authorship, or set up for the smallest pretentions to literary fame; the experience I have obtained in my profession, communicated in a plain intelligible manner, is all I purpose; my readers therefore I hope will rather attend to matter, than manner; and feeling its utility, not expect embellishments, of which was I capable, I should not avail myself.

"In endeavoring to perfect myself as a Dentist, I have employed some years, and (if a liberal practice does not much mislead me,) I may assert not unsuccessfully; but as even in the most extensive field of practice, there will ever remain a few, uninformed of the good effects which experience has made known to others: I trust I shall not be condemned for attempting to raise in estimation, an art, more beneficial in this climate, than most others.

"Though the subject is in some measure new here, I yet hope for every reasonable indulgence, having received the general approbation of the most eminent professors in Surgery and Medicine, who have not hesitated to assert its great utility, and the propriety of my treatment; which with that candour (the result of conscious integrity,) has been laid open to the strictest investigation.

"The word Dentist, has been so infamously abused by ignorant pretenders and is in general so indifferently understood, that I cannot forbear giving what I conceive to be its original meaning; viz. the profession of one who undertakes, and is capable of not only cleaning, extracting, replacing by transplantation and making artificial teeth; but can also from his knowledge of Dentistry, preserve those that remain in good condition, prevent in a very great degree, those that are loose, or in a decayed state, from being further injured, and can guard again the several Diseases, to which the Teeth, Gums, and Mouth are liable; a knowledge none but those regularly instructed, and who have had a long and extensive practice, can possibly attain; but which is absolutely necessary, to complete the character of a Surgeon Dentist.

"Little is presumed, need be said to induce every one to pay that attention to their teeth, which such useful ornaments require; particularly that part of the creation, in whom as a contemporary has observed "Beauty appears to have fixed her peculiar seat," I shall therefore without entering into anatomical disquisitions or latin phrases (which I think more calculated for the faculty than the public), briefly explain from whence those complaints, (so generally incident to all,) arise, and offer what I ever found to be the lasting, speedy and effectual remedy."

Following the main text of his treatise are the following interesting remarks:

"To *those worthy Gentlemen, ill-naturedly nomenclated* Quack-Doctors, Tooth-drawing Barbers, Nostrum Mongers *and* Itinerant Mountebanks."

"I had just finished this Treatise when I received an application to attend a lady whose upper jaw had been considerably injured by one of the greatest empirics of whom your fraternity can boast, and was thus reminded of a *duty* which has only lost its weight, I should presume, by the hackneyed manner in which it has hitherto been performed. Many, no doubt, are the pages my predecessors have lengthened out hereby, and conspicuous are the pages where an adage would apply; but waiving that or any other illiberal observation, without even premising to a generous public, that what sait

to you are hints to them, or vulgarly abusing merits and ingenuity, to which I am infinitely a debtor; suffer me in the language of obligation to state the kindnesses received and acknowledge with gratitude incumbent, the information your dexterity, and skill has enabled me to acquire. Various and intelligent has been the practice you have afforded, and *ad infinitum* I hope will be your labours to benefit society in general. The vile inuendoes, that you break Teeth, fracture the parts, cause exfoliations, dangerous haemorrhages, deep seated abscesses, or now and then a locked jaw, as instanced by Doctor Skinner, of New York, in his treatise, page 19, I trust and believe an enlightened community will pay no attention thereto; but will permit you long to reign the unmolested pratisers of mischief through your lives, giving to regular professors that knowledge so necessary to be obtained, and which denied by you can proceed from chance alone. In short, to real professors of the art, you are of the same utility dead subjects are to the anatomist, and mistaken is he who sees you in any other light. Malice and envy in vain shall shoot their shafts, while economy shall find the *charges* are so *moderate*.

"May you prosper in your undertakings, and may you never want a patient, until, by some unlucky well-meant, though misconceived jerk, twist, or otherwise injudicious accident, you proclaim your operations not performed *fecundum artem*."

XIX. SUBSEQUENT EARLY AMERICAN PUBLICATIONS

Beginning with the year 1814 there followed a rapid series of dental books written by some of the foremost practitioners of that period:

James, Benjamin: A treatise on the management of the teeth, 12*o*. Boston, 1814.

Parmly, L. S.: Practical guide to the management of the teeth, 24*o*. Philadelphia, 1816.

Parmly, L. S.: A practical guide to the management of the teeth; comprising a discovery of the origin of caries, or decay of the teeth; with its prevention and cure, 12*o*. Philadelphia, 1819.

Parmly, L. S.: Lectures on the natural history and management of the teeth; the cause of their decay; the art of preventing its accession; and various operations, never hitherto suggested, for the preservation of diseased teeth," 8*o*. New York, 1820.

Parmly, L. S.: Lectures on the natural history and management of the teeth, etc., 8*o*. 2nd ed. New York, 1821.

Flagg, Josiah F.: The family dentist; containing a brief description of the structure, formation, diseases, and treatment of the human teeth, 1 plate, 12*o*. Boston, 1822.

Parmly, Eleazer: An essay on the disorders and treatment of the teeth, 3rd ed. 12*o*. New York and London, 1822.

Gidney, Eleazer: A treatise on the structure, diseases, and management of the human teeth, 1st ed. 16*o*. Utica, 1824.

Gardette, James: Observations on the transplantation of teeth, which tend to show the impossibility of the success of that operation, 8*o*. Philadelphia, 1827.

Fitch, Samuel S.: Remarks on the importance of the teeth. On their diseases and modes of cure; with directions for forming regular and beautiful sets of teeth, 8*o*. Philadelphia, 1828.

Trenor, J.: A physiological inquiry into the structure, organization, and nourishment of the human teeth, 8*o*. New York, 1828.

During the decade from 1829 to 1839, the wheels of progress were set in rapid motion. In 1829 Samuel Sheldon Fitch published his "System of Dental Surgery" in three parts: 1—"Dental Surgery as a Science;" 2—"Operative Dental Surgery;" 3—"Pharmacy connected with Dental Surgery." This was the only work in the English language, up to that time, that attempted to cover the entire field of dental science and art, and shows that Fitch was well grounded in the literature of his profession, and well qualified for the task he undertook. He gathered together the writings of others, sifted it, and arranged the valuable material in a logical and clear order. The next important contribution to dental literature was written, in 1839, by Chapin A. Harris: "The Dental Art."

Up to this period, the dental literature with a few exceptions, was not noted for works of great importance, and few were of any real scientific value. Most of these were small books, intended more to advance the reputation of the writers than for the elevation of the profession. Dentists, in America, were too busily occupied with their practice to devote time to the preparation of books, which naturally resulted in a sparce dental literature. America was forced to look to Europe for its dental information, especially to France and England. Suddenly, a new interest was awakened in this country, and a strong literary inspiration began to pervade the leading men

of the dental profession. During the decade above mentioned, as other important works were added to dental literature, it must have become very evident to the more enlightened men in the profession that dentistry could not advance with each man pitted against the other in a veil of secrecy, and they conceived the idea that association was the remedy. In 1834 "The Society of Surgeon Dentists of the City and the State of New York" was organized. The life of this association was short, but it was the first attempt to bring together the leading men of the profession.

XX. THE YEARS 1839 AND 1840

The years 1839 and 1840 were without doubt the most important of any in dental history. Never before, nor since, have more monumental contributions been made to dental science or art in so short a period of time. Contributing factors were the publication of the first periodical devoted to dentistry in 1839, *The American Journal of Dental Science*. The influence of this special literature as a factor in giving form and character to dentistry, cannot even approximately be estimated. The organization of the Baltimore College of Dental Surgery seemed to open a path for a broader intellectual life in dentistry, and was seized upon in various sections of the country as the solution of many difficult problems. The formation of the American Society of Dental Surgeons, which remained in existence for sixteen years, was the pioneer in effectual association. The value and importance of these organizations is clearly shown by the fact that no marked progress is made where this instrumentality is not employed. Thus we find that the three great forces that have been especially instrumental in the development and progress of dentistry throughout the world were born almost simultaneously. The *American Journal of Dental Science*, was the beginning of journalistic literature for dentistry throughout the world and remained in the field for over sixty years. The Baltimore College of Dental Surgery, the first institution of its kind in the world, was established to impart a regular and systematic course of instruction in dental surgery. After eighty-three years of continuous activity, this college merged in 1923, with the University of Maryland, School of Dentistry. It was conceived by, and was the result of the efforts of, Hayden, Harris,

and Bond. The graduating class in 1841, consisting of Robert Arthur and R. C. Mackall, were the first to receive the degree of D. D. S. in course. The American Society of Dental Surgeons demonstrated some valuable objectives to be attained by association, and also the proper direction dentistry should take to be worthy of its name.

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40 East 41st Street

XXII. ADDENDUM

Fig. 33, on page 388, shows the title page of a dental book by Guillermo S. Parrott, probably the first ever printed in Mexico (1823; 56 pp., 18 mo.). This work is extremely rare, and I have not been able to locate it in any bibliography. It was written to help to remedy the deplorable state of the "dental art" in Mexico, and gives the author's experiences with the different methods of "cure," as practised in England, France, United States, and the Antilles Islands.

REFLEXIONES

SOBRE

LA IMPORTANCIA DE CONSERVAR

LA

DENTADURA

Y

MANEJO NECESARIO

AL EFECTO.

EN LO QUE SE INCLUYEN

UNA EXPLICACION DE LOS PRINCIPIOS TEORICOS DE *DENTISTA*,

Y UN MÉTODO PRACTICO

DE

CURACION

EN CASOS DE ABANDONO.

ESCRITAS EN INGLES

POR GUILLERMO S. PARROTT

Profesor Dentista,

Y TRADUCIDAS DEL ORIGINAL AL CASTELLANO

POR F. L. DELAHANTY.

MEXICO.

IMPRENTA DE LORRAIN,

1823.

FIG. 33. Title page of the book by Guillermo S. Parrott (1823). Probably the first dental book printed in Mexico.

PROPHYLACTIC ODONTOTOMY[1]

An Operative Procedure for the Prevention of Decay

THADDEUS P. HYATT, D.D.S., F.A.C.D.

Dental Director of the Metropolitan Life Insurance Company, New York City

I am deeply grateful for your invitation to discuss with you, and with so many of my most intimate and life-long friends in our profession, this important problem in dental procedure. The solution of this question will mean much for the children of today, but far more for the adults of tomorrow. You are asked to consider, whether the adoption of the procedure advocated in prophylactic odontotomy will bring about conditions that are worse and more deplorable than those found today, or, if this procedure is put into actual practice in all children's dental clinics and in private practice, whether it will be helpful in saving teeth and in reducing the ravages of dental caries. Should your decision be favorable, may I ask for the sake of children everywhere that you take official action in the form of a resolution? I ask this because I feel that the adoption of such a resolution will at once remove this question from the realm of *personal opinion* and make it the carefully considered judgment of a professional organization. Such decisions, when published in our dental journals, have far greater value and interest to the profession at large than the views of any individual. With this introduction permit me to present my paper.

During the past twenty years our profession has become greatly interested in the question of how to prevent dental caries. In time, many different procedures may be, and probably will be, discovered by which this desirable result shall be obtained. Your essayist, however, is confining his attention to one condition only, or one

[1] Read at a meeting of the New York Academy of Dentistry, New York City, October 22, 1925.

phase of this question. He is attempting to show logically, as well as statistically, the necessity of doing something to the occlusal side of molars and bicuspids which have non-carious fissures, pits, or deep narrow grooves. He wishes also to emphasize the importance of doing this as soon as possible after the eruption of these teeth and *before decay* has penetrated the enamel. The absence of dental caries in children's mouths is not an authoritative or safe sign for our guidance. There may not have been sufficient time for the bacterial plaques to bring about enough destruction of tooth substance to be observed by ordinary clinical examination. We must remember that the first stages of decay are microscopic and cannot be detected even with the aid of the finest instruments. We cannot tell if mouth conditions are such that bacterial plaques may form. We only know that bacterial plaques are present when they are attached to the teeth. We cannot foretell when in the future certain systemic conditions will cause bacterial plaques to appear in the mouth.

It should be our duty as well as our great pleasure to evolve a procedure for the treatment of non-carious teeth that may keep them non-carious for the entire life of the patient. This suggests that a new subject should be taught in our dental colleges, namely, the treatment of *non-carious teeth to make them comparatively immune to dental caries*. Too little thought and too little attention have been given to non-carious teeth. All the interest and attention of the student is directed to the question of dental caries. They are most carefully, elaborately, and scientifically instructed how to detect it, how to remove it, and how to treat it if all of it cannot be removed. There is little to be added to the art and science of reparative work. When no caries is found most of the interest is lost because there are no opportunities for artistic gold inlays, porcelain restorations, pulp removal, root-canal treatments, x-ray diagnosis, etc. The student, not having been instructed in the art and science of immunizing non-carious teeth, finds little to do when no caries is present. Study the curriculum of any dental college, the program of any dental convention, the articles in any dental magazine, and you will find about 95 per cent of the subjects are devoted to the problems of caries, or to those conditions that are the results of caries. In four of the leading dental journals for July 1925 there were forty articles, but only one

of them was in any way related to the subject of the prevention of caries. If we should remove from our programs the subjects that are related to dental caries and its treatments, it is doubtful if a dental convention could be held.

Our profession has not acquired the "preventive" psychology, the "preventive" mental habits, the "preventive" outlook. Our thoughts and our conversation with dental friends, even outside of dental meetings, is generally on questions of crowns, attachments, bridges, direct or indirect methods for gold inlays, etc. We pass by small openings in the enamel with the mental reservation that they may not decay, for most likely the patient is immune, or perhaps the little decay we see is retarded decay. We little appreciate, or seldom remember, that there is no way of telling the difference between retarded and active decay. We also inherit from the past the fear of being accused of making holes for the sake of putting in fillings, little realizing that a large part of the public has already learned, and the balance is fast learning, that prevention is better than cure. As we do not see prevention or think in terms of prevention, it is not strange that it is difficult quickly to establish a real preventive procedure, particularly when to make it a success it is necessary to advocate operative procedures on non-carious teeth.

It is my purpose this evening to consider a few of the objections that have been made against the endorsement and adoption of prophylactic odontotomy as a regular practice in the dental clinic of the public school and in private practice.

One objection is that in the hands of the unscrupulous or unskilled dentist much harm can be done. Does not this objection apply with equal force and logic to all phases of our work? Have we not seen much harm done to teeth in preparing them to serve as abutments for bridges? Have we not seen more damage done and more tooth structure destroyed since the introduction of the gold inlays? Instead of "extension for prevention," is it not now extension for gold inlays by the unskilled and unscrupulous dentist? Extension for prevention does not necessitate cutting deep and wide cavities in non-carious grooves having fissures at their base. The percentage of recurrent decay at the cervical margin of gold inlays made by unscrupulous and unskilled dentists is undoubtedly much higher than the percentage

of recurrent decay at the cervical margin of gold foil or amalgam fillings made by skillful and conscientious dentists. But is this a reason for condemning the practice of gold-inlay work? Cannot the same objection be raised against any operative work or even against any prosthetic work done by unscrupulous and unskilled dentists? Are there not far greater opportunities for irreparable damage being done to the patient by the unscrupulous and unskilled dentist in root-canal work without the patient's knowledge, than there is in the making of small fillings? The success of dental caries in the destruction of the teeth can never be equaled by the mutilation that might be done by a few unscrupulous and unskilled dentists. I cannot see any argument or logic in this objection.

Another objection is the statement that once we cut into a tooth we have made the tooth vulnerable and have increased its susceptibility to caries. Inasmuch as pin-hole fillings last for years and years with no signs of decay, even in mouths having a large amount of caries elsewhere, this objection is not supported by logic or by facts. It is interesting to read what Dr. Brackett of Boston says about occlusal fillings: "And there is this peculiarity about reparative work on occlusal surfaces; when it is once done, it is usually done forever; because with the insertion of a proper filling, we overcome completely and forever the operation of the causes that lead to the formation of such a cavity. It is not so difficult to give proper attention to occlusal cavities. I think you will all agree, that in operative dentistry the small cavities in the occlusal surfaces are the most manageable kind of cavities."[2]

It does not seem logical, scientific, or even probable that the cutting out of "areas" of imperfections such as pits, fissures, or deep narrow grooves in the occlusal side of molars and bicuspids, and properly filling them, will in any way increase the susceptibility or vulnerability of these teeth to decay. In view of what Dr. Brackett has said, it seems only reasonable to believe that this procedure will make these surfaces comparatively immune to decay. We must also remember that these fissures will eventually decay. They must be filled some day. The question to decide is whether it is more scientific

[2] Brackett: *Dental Items of Interest*, 1924, xlvi, p. 604.

to open and fill before decay starts, or more scientific to wait and fill after the acid of decay has penetrated into the dentine. At the Forsyth Dental Infirmary, in Boston, children's permanent molars having occlusal pits and fissures are now being treated six weeks after eruption. The results are sufficient proof for the soundness and value of Prophylactic Odontotomy.

Another objection is that we often find pin-hole fillings that were probably put in by dentists who desired to make cavities where no cavities had existed. I most sincerely doubt this, for the reason that I have never seen any pin-hole fillings in areas of the tooth where decay rarely enters. For example, I have seldom seen pin-hole fillings in the lingual side of lower incisors. The pin-hole fillings that I have seen in the occlusal side of molars or bicuspids are always located where pits or fissures may be found. These pin-hole fillings or narrow-fissure fillings are the ones that can boast of 30, 40, or even 50 years of undisturbed service. The patient's best thanks are due to those professional men who did not stand idly by and wait until the acid of decay had created cavities large enough for gold inlays. There are the dentists who courageously took time by the forelock and opened up these non-carious fissures, pits, or deep narrow grooves, and left small fillings as perpetual memorials to their wisdom and skill.

The objection that the acceptance of prophylactic odontotomy by our profession would lead men to make cavities when none exist or would exist, I do not consider logical when we understand what statistics teach us on this subject. We must realize that, of the teeth in which a fine-pointed explorer sticks in a pit, fissure, or a deep narrow groove, 99 in every hundred will decay. We must realize that we have no way of telling which is the one that will not decay. Knowing that decay will start in practically every one of these pits and fissures; knowing also the insidious nature of this decay, in that it will spread out under the enamel along the dentino-enamel junction without giving any external evidences of its progress; knowing that the acid of decay penetrates into the tooth structure far beyond any visible evidences of decay; and knowing that the permanency of any filling is greatly increased when surrounded by sound-tooth substance which has not been affected by the acid of decay—knowing

all this, is it not more logical and more scientific to open and fill these pits, fissures, or deep narrow grooves before decay has started than to wait until decay has made sufficient progress to become visible and well established in the dentine?

Another objection is the following; there are thousands of molars in adults which have non-carious occlusal fissures, therefore it is unscientific, unprofessional, and even unmoral to cut out these non-carious occlusal fissures when *perhaps* they may never decay. This objection, I believe, has been largely based upon impressions received from clinical experience. Clinical impressions are more apt to mislead us than to instruct us. Unless we have carefully recorded our clinical observations at the time they were made and have frequently studied these records, it is wise not to offer the impressions we received from our clinical work as facts or as objections to statistical findings.

A very careful examination of 1160 first and second molars in 145 adults between 30 and 40 years of age showed that 482 (41 per cent) molars were lost; 488 molars had occlusal fillings, 90 molars had occlusal carious cavities which had not been filled, 88 molars had no occlusal carious cavities *and no occlusal fissures*, and only 11 molars had non-carious occlusal fissures in which a fine pointed explorer could stick. In other words, less than 1 (0.96 per cent) in every 100 molars in the mouths of these adults between 30 and 40 years of age had non-carious occlusal fissures.

Dr. Ottolengui's statement of 25 years ago, that "these imperfections are not seen in adults' mouths, because where they exist cavities will be formed before puberty," is just as correct today as it was then. We are willing to allow to every man the privilege of changing his opinion, particularly after 25 years; and he has also the privilege of changing it again during the next 25 years, but it is not necessary because man changes his opinion once every 25 years that truth must also change. Truth remains consistently the same throughout the ages.

Dr. Kirk[3] writes, "What are immune *areas* is still an open question for the simple reason that the *factors* of immunity and susceptibility to caries are still unsolved problems."[4] The fact that certain *areas*

[3] Kirk: *Dental Cosmos*, 1923, lxv, p. 319.
[4] Italic does not appear in the original.

of some teeth rarely if ever decay, even in mouths having large amounts of caries, certainly justified the belief that to all intent and purposes certain areas of the teeth are comparatively immune to caries. We realize of course that there cannot be absolute immunity, any more than there cannot be absolute susceptibility. It is not the structure of the tooth that creates primarily its susceptibility to decay, though it needs no argument to believe that poor structure will increase the rapidity of decay. It is the shape and formation and also the location of certain areas of the teeth that makes these areas vulnerable, and therefore more susceptible to decay than other parts.

A thorough examination of 2174 young women between 17 and 25 years of age showed that there was less than 0.06 per cent of the lower incisors had carious cavities in the lingual side. This is equivalent to saying there is practically no decay in the lingual side of these teeth. Of the 17,392 first and second molars, 4415 were lost, crowned, or unerupted. Of the 12,977 molars left, 73 per cent had occlusal carious cavities or fillings. In other words there are 1216¾ times more carious cavities or fillings in the occlusal side of the molars in this group of 2174 young women than in the lingual side of the lower incisors. If we take under consideration all of the teeth in this group of 2174 young women, the figures are even more striking and interesting. Deducting the number of teeth unerupted, crowned, extracted, or badly decayed, 57,573 are left. In the mesial, distal, buccal, and lingual sides of these teeth there are 10,578 cavities or fillings. In the mesial and distal sides alone there are 6863 cavities or fillings. Should these be equally divided, there would be 3421 cavities or fillings in the mesial side and the same number in the distal side. The occlusal side of the 12 incisal teeth rarely have occlusal carious cavities. The 12 incisal teeth, however, very frequently have mesial or distal cavities. This practically leaves only the molars and bicuspids as having occlusal cavities or fillings. We find 16,995 cavities or fillings in the occlusal side of these teeth. This is more than four times as many as in the buccal and lingual sides combined, and four times as many as in the mesial or distal sides. There were also 1978 compound fillings in which the occlusal side is one of the sides involved. They were M.O.D., D.O., L.O., M.O.,

and B.O. These have not been included in securing the percentage already mentioned.

Therefore, I think it is not unreasonable nor unscientific to speak of the occlusal side of molars as being susceptible to dental caries, and the lingual side of the lower incisors as being comparatively immune. The logic of this position is greatly increased when we confine this nomenclature to certain restricted areas of these surfaces and say, for example, that occlusal pits and fissures in molars and bicuspids are vulnerable areas, and therefore more susceptible to decay.

Dr. J. Leon Williams writes: "Cavities never form except at localities where bacterial plaques may form and act undisturbed."[5] If this is true, and I see no reason to doubt the scientific accuracy of this statement, then vulnerable areas are those which, because of their location or formation, permit the undisturbed adhesion of bacterial plaques; whereas areas of immunity are those where bacterial plaques, because they are easily disturbed, do not generally adhere. Occlusal fissures, pits, and deep narrow grooves being so shaped as to afford lodgment for and undisturbed adhesion of the bacterial plaque, must be vulnerable.

Faulty formation of the enamel, of itself and by itself, cannot be the *cause* of caries, because the enamel is something that is acted upon or in. If faulty formation were the cause there would be no need for external agencies. However, the fact that the largest percentage of carious cavities are found where pits, fissures, or deep narrow grooves exist surely shows that these areas are predisposed or are susceptible to dental caries. The reason for this is easily understood. These places offer the necessary lodgment for and the undisturbed retention of the bacterial plaques, and thus permit the acid of decay to penetrate into the tooth.

The acid of decay depends on the bacterial plaque for its creation. Dental caries cannot take place without the presence of the acid of decay. Bacterial plaques do not easily adhere to surfaces which are so shaped that they are kept clean by mastication, movements of the soft tissues of the mouth, or by artificial cleansing such as by

[5] Williams: *Journal of Dental Research*, 1923, v, p. 194

the use of the brush, floss silk, etc. Areas of the teeth that face interproximal spaces; deep narrow grooves; malformation of the enamel, such as pits and fissures—these are places difficult to keep clean, and which constitute, and in fact are the necessary environments for, the lodgment and undisturbed retention of the bacterial plaques. Outside of these areas, free acids of the mouth do produce caries in the teeth.

In the Eastern Philosophies the Manifested Universe is divided into pairs of opposites. In fact without these pairs of opposites there can be no manifestation, or at least we could not comprehend or know it. For example, if there is no South there can be no North; if there is no darkness we cannot know light; no heat, and there would be no cold; if there is no inside, there can be no outside. We must have the positive as well as the negative, the active as well as the passive. Without these pairs of opposites there can be no manifestation. In studying dental caries may it not be logical, and in accord with well known facts, to believe that there are two factors necessary for dental caries and not only one? May it not be that while the *active* factor is the bacterial plaque, the *passive* factor is that area of the tooth which, owing to its formation or location, provides the environment that is favorable for the undisturbed retention of the active factors? The union of these two factors, the active and the passive, brings about the manifestation of dental caries. With only one of these factors present there can be no manifestation of dental caries. If there are no bacterial plaques on teeth there will be no caries, regardless of the structure and formation of the teeth. If there are no areas that afford lodgment and undisturbed retention for the bacterial plaques, there will be no caries regardless of the presence in the mouth of free bacteria. Therefore, it seems both logical as well as scientific to state that there are areas of susceptibility and that these areas are the passive factors of decay.. Also, that there are areas of immunity and these are the areas which do not provide the favorable environment for the undisturbed retention and localization of the bacterial plaques.

In offering this as a solution of the problem as to what are the *factors* of immunity and susceptibility of certain areas of the teeth, I am not unmindful of the fact that the *cause* or *causes* which bring

about these forms or imperfections of the enamel are systemic or constitutional. These pits, fissures, and deep narrow grooves are vulnerable and therefore they increase the susceptibility of the tooth to caries. While it is undoubtedly true that much may be discovered regarding questions of prenatal influence, nutrition, and the proper feeding of infants and young children, we must not lose sight of the very important fact that over 2000 molars and bicuspids are erupting every minute of the day and night. No nutrition, no systemic treatment can or does change the shape and form of fissures, pits, or deep narrow grooves once the tooth has erupted.

If we are to prevent the manifestation of occlusal dental caries, operative procedures must be directed to these vulnerable areas *before decay starts*. They must be made areas that are easily cleansed and thus difficult for the undisturbed attachment of the bacterial plaques. Over the active factors of dental caries we have as yet little or no control. Over the passive we have control, because it is quite within our knowledge and ability to change the form of these passive factors in the occlusal side of molars and bicuspids so that they can no longer offer favorable environments for the undisturbed retention of the active factors. When the active factors are not present in the mouth there is no decay, but it is not logical nor is it correct to say such mouths are immune to caries. This is one of the mistaken ideas which have come about because research workers in dental caries have always emphasized the fact that faults and imperfections in the teeth are not the cause of decay. They tell us it is important to know that the bacterial plaque is the active cause of dental caries. They then proceed to call those mouths immune that show no caries. There is no need of immunity when there is nothing present in the mouth to start decay in the teeth. Immunity implies that the teeth will not decay even when there is present in the mouth those conditions that bring about decay. That there are such teeth and that there are such areas of immunity is amply shown by the figures already given.

For years and even centuries our profession has been looking for and studying dental *caries*. It is not strange nor surprising that we should find that for which we look. Let us now look for and study those teeth and those tooth areas which are comparatively immune to

decay. In this way we shall gain the knowledge, the art and science, of *dental immunity* and thus learn the operative requirements for the practice of the new and ideal dentistry—*the prevention rather than the removal of decay.*

Permit me to ask you to consider the following statements and to express your opinion as to whether they are true, and scientific:

(1) Only slight caries in the dentine is necessary to bring about pulp reaction and possible pulp pathology.

(2) Dentine in newly erupted teeth is more susceptible to the acid of decay than in later life.

(3) The undisturbed retention of bacterial plaques is necessary to bring about dental caries.

(4) The bacterial plaque is the *active* factor in dental caries.

(5) Any formation of the enamel which permits the adhesion and undisturbed retention of the *active* factor of decay is a constant menace to the integrity of the tooth.

(6) Occlusal pits, fissures, and deep narrow grooves provide the necessary environment for the undisturbed retention of bacterial plaques, and are therefore *passive* factors of decay.

(7) We have no technique by which we may know when mouth conditions favor the production of the *active* factors of decay, and are not able to detect them when they are unattached to the teeth.

(8) We have the technique by which we may know when the *passive* factors are present.

(9) The greatest danger presented by occlusal caries in newly erupted permanent molars and bicuspids is that the decay may become quite extensive under the enamel without showing any external evidence of its spread.

(10) The only clinical indication of the presence of an occlusal fissure is the sticking of a sharp pointed explorer when properly applied.

(11) Occlusal carious cavities are seldom found elsewhere than in the developmental grooves or pits.

(12) Prevention or great reduction of the ravages of decay can be attained only by starting with the occlusal side of permanent molars and bicuspids as soon as possible after they make their appearance in the mouth.

(13) Statistics show that there are from four to twenty times as many carious cavities in the occlusal side of molars as in any of the other sides.

If you agree that the above statements are true and scientific, then the only logical deduction that can be made is the following: When defective enamel formations, such as pits, fissures, or deep narrow grooves, are found in the occlusal side of newly erupted molars and bicuspids, operative procedure is indicated regardless of the fact that there may be no visible signs of decay.

It will be many years before the benefits of nutrition can be established on a permanent and scientific foundation for the masses of the people. Until that time we can at least change these vulnerable areas in the occlusal side of molars and bicuspids into areas of comparative immunity, by removing or protecting the *passive* factors of dental caries, and thus make it difficult if not impossible for the *active* factors to operate. With these passive factors removed by any one of several operative procedures, and with proper hygiene of the mouth, right living, and better food, our profession will become the active and beneficent factor in the increase of the health and happiness of mankind, and thus become the leader in the new science of preventive medicine.

DISCUSSION

Charles Bödecker, D.D.S., F.A.C.D. (*New York City*): The subject of Dr. Hyatt's paper is one of vital importance to the dental profession. The essayist has clearly brought out the fact that we have been interested principally in repairing the ravages of dental caries, and all too little in attempting to prevent this disease. In 1922, the first presentation by Dr. Hyatt on "prophylactic odontotomy" caused several misunderstandings, but I believe we can say now that these were of great value to the profession, even though they brought a storm of protest and ridicule, for they awakened general interest in this subject. These misunderstandings and misinterpretations have now been cleared to a great extent.

The principal reason for the misunderstanding was the wrong interpretation of the term "fissure," which dental anatomists are unanimous in defining as a fault in the development of the enamel at a place usually occupied by a groove, just as Hyatt has done. It might be of interest to see the manner in which a fissure and a groove develop embryonically. This can best be demonstrated by the following lantern slides (*figs. 1–6*).

"The laying down and calcification of both the dentine and the enamel in the crown of a tooth commence at the dento-enamel junction on the summits of the cusps. That is, there are as many centers of calcification as there are cusps in the future tooth. These areas can therefore be regarded as the oldest parts of the teeth."[6] We see this portrayed in *fig. 1*, where the two tiny cusps of the future tooth, composed of dentine and enamel, are quite close together. The dotted line shows the outline of the future tooth. *Figure 2* shows the progress in the development; the cusps have enlarged

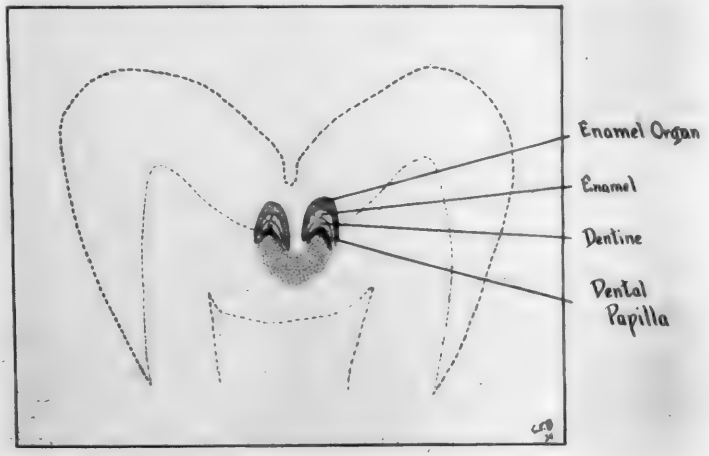

FIG. 1. THE FIRST IN A SERIES OF DRAWINGS THAT SHOW THE EMBRYONIC DEVELOPMENT OF THE CUSPS, AND THE FORMATION OF GROOVES AND FISSURES, IN THE CROWN OF A MOLAR TOOTH

The tiny cusps of the future tooth, composed of dentine and enamel, are close together. The dotted line shows the outline of the future tooth. (See *fig. 2.*)

and their centers have moved away from one another, but as yet no junction of the two has taken place. This does not happen until they have reached their normal position, shown by the dotted lines. When the cusps have once been united by a solid base of dentine, no change in this distance can take place. As seen in *figs. 1 to 5*, the enamel is formed more rapidly on the summit of the cusps than in the base of the groove. The last part of the occlusal surface of the crown to be completed is the future site of the groove.

[6] Bödecker: Dental Histology and Embryology; Macmillan, New York, 1926.

Figure 5 shows the development of a normal groove. The lobes of enamel that form the individual cusps, having coalesced, are separated only by a perfectly calcified furrow or groove.

Let us now see why dental caries penetrates these fissures so insidiously and often so deeply before the patient receives a warning. *Figure 7* shows in a diagrammatic manner the usual condition of a molar regarding which the dentist concludes that the fissure is carious, and decides to excavate and insert a filling. The darkened area in the diagram represents decay.

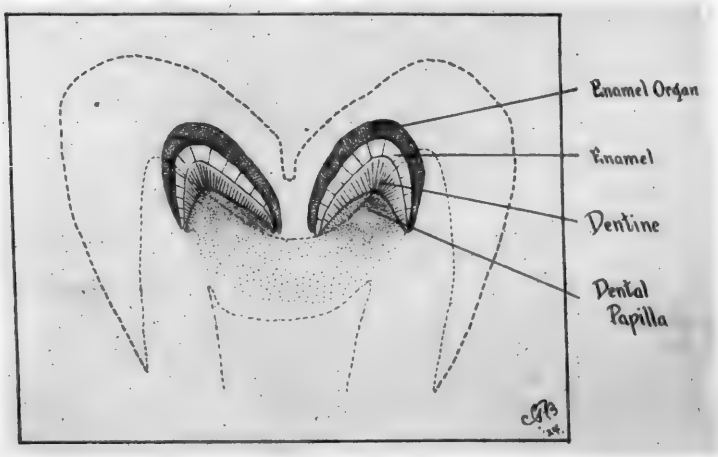

FIG. 2. THE SECOND IN A SERIES OF DRAWINGS THAT SHOW THE EMBRYONIC DEVELOPMENT OF THE CUSPS, AND THE FORMATION OF GROOVES AND FISSURES, IN THE CROWN OF A MOLAR TOOTH. COMPARE WITH *fig. 1*

The cusps have enlarged and their centers have moved away from one another, but junction of the two has not yet taken place. (See *fig. 3.*)

You will note that the opening of the fissure is so minute that the finest explorer can barely penetrate it, and yet the decay has spread out in such an alarming manner at the dento-enamel junction that a considerable portion of enamel on either side of the fissure has been undermined. The extent of excavation necessary to obtain sound enamel margins is considerable, if you remember that the enamel forming the walls of a cavity ***must always rest upon sound dentine.***

Another point of interest in this diagram (*fig. 7*) is the direction of the enamel rods; they are inclined in such a manner that decay need only form a

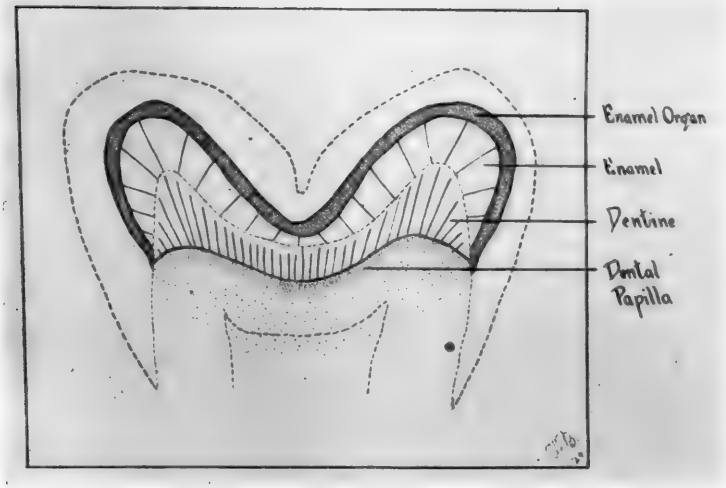

FIG. 3. THE THIRD IN A SERIES OF DRAWINGS THAT SHOW THE EMBRYONIC DEVELOPMENT OF THE CUSPS, AND THE FORMATION OF GROOVES AND FISSURES, IN THE CROWN OF A MOLAR TOOTH. COMPARE WITH *figs. 1 and 2*

The cusps have been joined in their normal relationship on a base of dentine. (See *fig. 4.*)

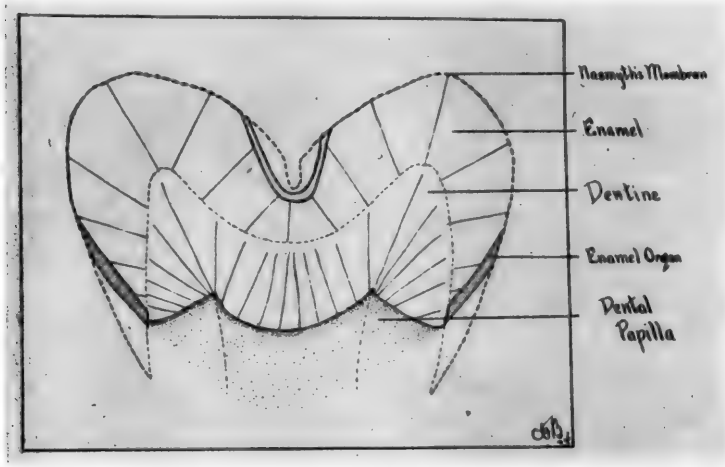

FIG. 4. THE FOURTH IN A SERIES OF DRAWINGS THAT SHOW THE EMBRYONIC DEVELOPMENT OF THE CUSPS, AND THE FORMATION OF GROOVES AND FISSURES, IN THE CROWN OF A MOLAR TOOTH. COMPARE WITH *figs. 1–3*

The enamel is formed more rapidly on the summit of the cusps than in the base of the groove. The last part of the occlusal surface of the crown to be completed is the future site of the groove. (See *fig. 5.*)

minute external orifice. For this reason the subjective symptoms of the patient appear only after considerable tooth substance has been destroyed. If the orifice of a cavity on the occlusal surface of a molar were wide, as is the case on most other surfaces of the teeth, food would be packed more readily into the cavity by the act of mastication and the ensuing pain would attract the attention of the patient. But as we all know, this is not the case, and therefore the patient is perfectly oblivious of the progress of

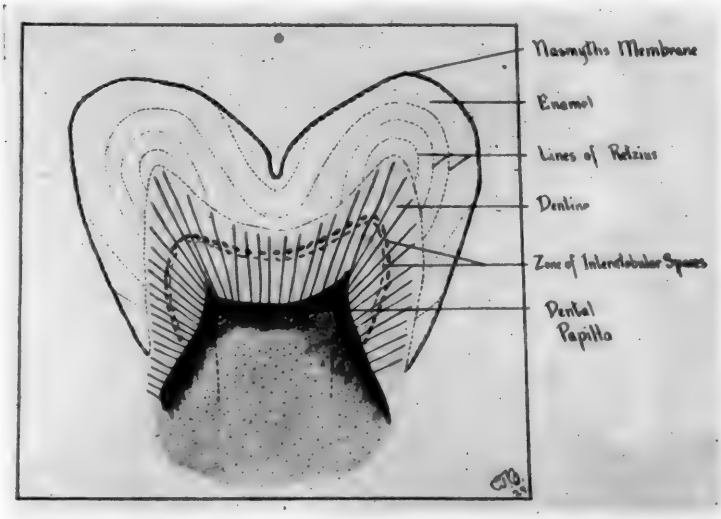

FIG. 5. THE FIFTH IN A SERIES OF DRAWINGS THAT SHOW THE EMBRYONIC DEVELOPMENT OF THE CUSPS, AND THE FORMATION OF GROOVES AND FISSURES, IN THE CROWN OF A MOLAR TOOTH. COMPARE WITH *figs. 1–4*

The last stage in the development of the crown, with a normal groove. The lobes of enamel that form the individual cusps, having coalesced, are separated only by a perfectly calcified furrow or groove. (See *fig. 6.*)

decay in the fissures of molars and bicuspids until considerable damage has been done.

At last year's meeting of the New York State Dental Society, at Binghamton, I presented a preliminary communication on the "Microscopic study of enamel fissures with reference to their operative treatment."[7] A few of the illustrations may be of interest in discussing Dr. Hyatt's

[7] Bödecker *Dental Cosmos*, 1924, lxvi, p. 1054.

paper. I set up a classification of the teeth in order to assist the inexperienced to decide which teeth are particularly prone to decay. This classification is based on the form and color of the molars and bicuspids, and is divided into three types and two sub-types. It has been my experience that high cusped, and correspondingly deeply grooved teeth, of a grayish

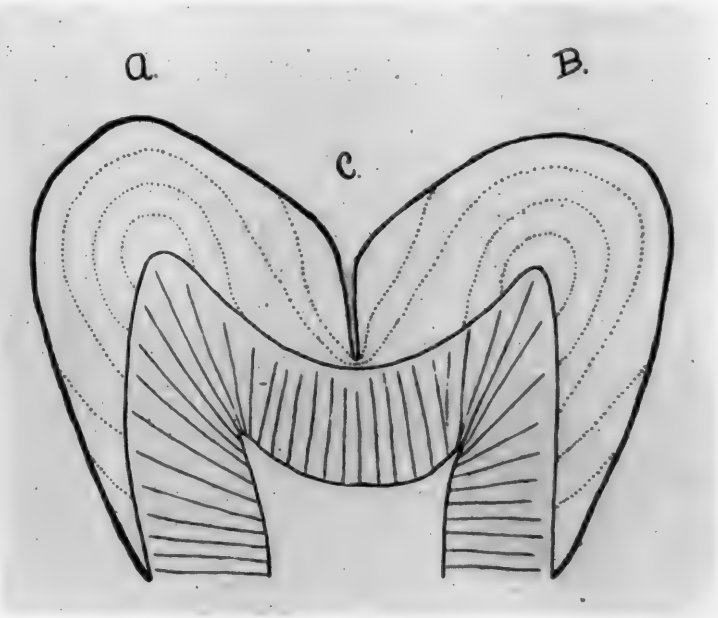

FIG. 6. THE SIXTH IN A SERIES OF DRAWINGS THAT SHOW THE EMBRYONIC DEVELOPMENT OF THE CUSPS, AND THE FORMATION OF GROOVES AND FISSURES, IN THE CROWN OF A MOLAR TOOTH. COMPARE WITH *figs. 1–5*

The drawing shows the development of a typical fissure instead of a groove. Fissure *C* encloses a double layer of Nasmyth's membrane and is formed by lack of coalescence of the lobes of the enamel, *A* and *B*. (See *fig. 7.*)

color, are more prone to caries than low cusped, shallow grooved ones with a yellowish color.

In the original statement Dr. Hyatt said, in effect, that occlusal fissures should be filled *before* decay sets in. Considering the insidiousness and depth to which decay may penetrate a fissure, without inducing subjective symptoms, and the irreparable harm that may be done to the pulp,

I believe that Dr. Hyatt was right in his original contention. I have personally refrained from following and advocating the radical treatment of fissures until I could make a thorough study of this problem. But now, from the aspect of histopathology, I give it my unqualified endorsement.

Harold DeWitt Cross, D.D.S., F.A.C.D. (*Boston, Mass.*): I would ask your indulgence for presenting a very informal discussion. After receiving

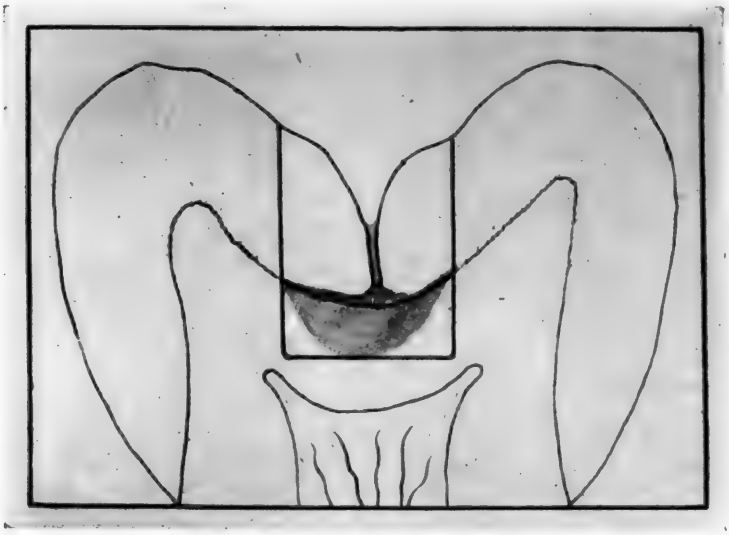

FIG. 7. THE INSIDIOUS PENETRATION OF DENTAL CARIES FROM A FISSURE ALONG THE DENTO-ENAMEL MARGIN

The drawing shows the usual conditions of a molar regarding which the dentist concludes that the fissure is carious, and decides to excavate and insert a filling. The darkened area represents decay. The size of the corresponding cavity to be excavated is shown by the heavy lines in rectangular arrangement.

the kind invitation of your chairman to attend this meeting, I had to spend practically all of my time in writing a paper to be presented before the American Public Health Association in St. Louis, and in travelling there and back. Consequently, I have only some notes that were prepared on the way.

I consider this the most important subject confronting dentistry at the present time. It is fundamental to our present day practice of dentistry.

All our inlays, large fillings, and root-canal work are dependent upon dental caries. If we could eliminate it, a large proportion of the work we are doing would be unnecessary. I think if every one were to take up the practice of prophylactic odontotomy and continue that practice for twenty years, we would eliminate 95 per cent of these troubles. Later on I will give you my reasons for believing this to be true. I do not suggest that prophylactic odontotomy is preventive dentistry. I believe Dr. Hyatt does not claim

FIG. 8. A PHOTOMICROGRAPH OF A GROUND SECTION OF A DECIDUOUS MOLAR OF THAT TYPE OF TOOTH THAT DOES NOT DECAY READILY

Note that the cusps are low and the groove shallow, allowing but slight possibility for the retention of food or the formation of plaques.

that it is, but only that it is early treatment. I think that, while we wait for the development of preventive dentistry, no other procedure is so satisfactory. While we educate ourselves and the public, and the research men try to determine what preventive dentistry should be, this is the thing upon which we should focus our attention. I think when preventive dentistry does come, it will not be a dental procedure at all. It cannot be, because we cannot fill a cavity which has been prevented; we cannot pre-

FIG. 9. GROUND SECTION OF A PERMANENT MOLAR, SHOWING IDEAL GROOVE FORMATION THAT OFFERS NO POSSIBILITY FOR THE LODGEMENT OF FOOD OR BACTERIAL PLAQUES

The abraded cusps show intensive use of the tooth. Caries is not liable to develop in teeth of such anatomical form.

FIG. 10. A MOLAR SHOWING A SOMEWHAT HYPOPLASTIC DEVELOPMENT OF THE ENAMEL

The grooves are wide and shallow so that the toothbrush bristles shown in the photograph can easily keep the occlusal surface clean. Caries does not develop.

FIG. 11. A DEEP NARROW GROOVE IN RELATION TO FINE (0.17 MM.) AND COARSE (0.26 MM.) TOOTHBRUSH BRISTLES

A part of a bacterial plaque is seen in the groove, which is likely to cause this area to become carious.

FIG. 12. THE CENTRAL GROOVE IS FAIRLY WIDE, HAVING HOWEVER AT ITS BASE A COMPLETE FISSURE EXTENDING DOWN TO THE DENTINE

Such an area should be excavated and filled soon after the eruption of the tooth. On the extreme right a wide incomplete fissure is seen, which does not endanger the tooth to the extent the central one does, as there is an area of sound, well-calcified enamel separating it from the dentine.

FIG. 13. A DEEP, NARROW CENTRAL GROOVE AND FISSURE EXTENDING DOWN TO THE DENTINE

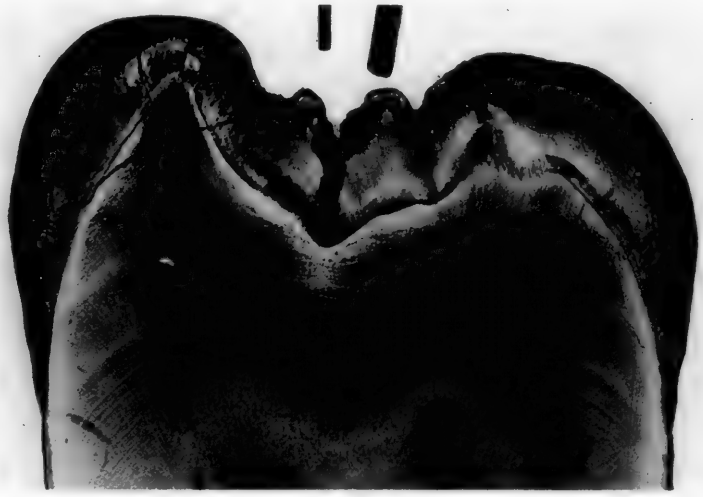

FIG. 14. A DEEP AND EXCEEDINGLY NARROW GROOVE AND FISSURE. ITS WIDTH IS 0.06 MM. (THE DIAMETER OF A FINE SCALP HAIR)

The relative size of fine and coarse toothbrush bristles shows the absurdity of expecting the patient to keep such areas free from food debris and bacterial plaques.

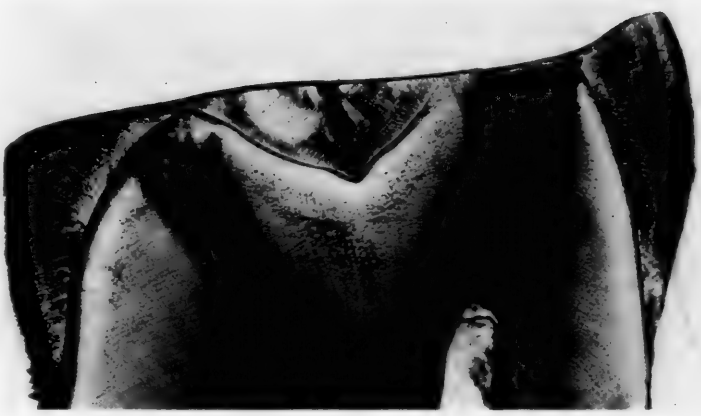

FIG. 15. AN INCOMPLETE FISSURE IN A STRONGLY ABRADED MOLAR, SHOWING THAT INTENSE MASTICATION IS AN IMPORTANT FACTOR IN KEEPING THE TEETH FREE FROM CARIES

The groove has been entirely ground out, preventing the lodgment of food or bacterial plaques. As a result, the fissure did not decay.

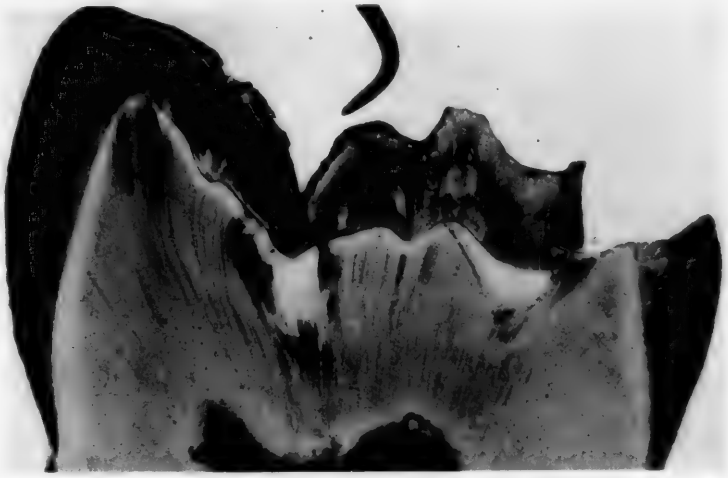

FIG. 16. A WEDGE SHAPED GROOVE AND COMPLETE FISSURE IN WHICH THE DARBY EXPLORER WOULD NOT "CATCH"

Caries has penetrated into the dentine, which was not visible from the exterior.

vent something which has already occurred. It must be something of a metabolic nature.

Dentistry is now passing through a very serious and important period.

FIG. 17. A TYPICAL HIGH CUSPED, DEEP-GROOVED BICUSPID, SHOWING THE MEREST OPENING AT THE BASE OF THE GROOVE, WHICH COULD NOT BE DIAGNOSED WITH AN ORDINARY EXPLORER

Caries has already partially liquified the dentine, undermining the enamel to a considerable degree.

Many of the usual procedures are failing, and there are few ways by which we can carry out the ideals of preventive dentistry. We must meet this issue, whether we wish to or not. We must approach it freely and frankly, and adapt our practice to it. Failure to do so, I think will be a very serious

thing for dentistry, and will result in confusion and perhaps ridicule. The public is becoming rapidly informed, and we must lead and not follow. We should adopt everything that has the appearance of supplying the

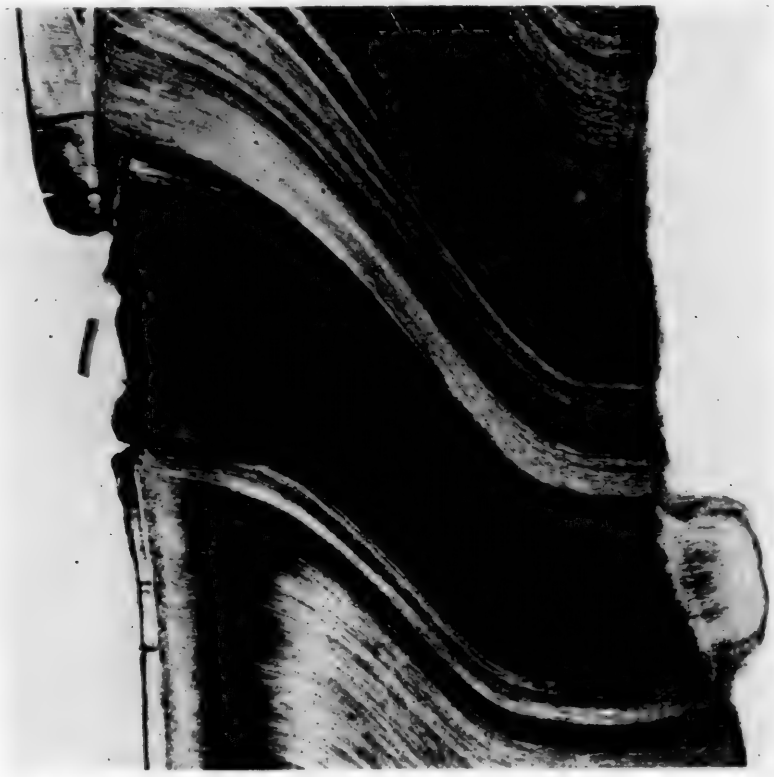

FIG. 18. SHOWS A TYPICAL GINGIVAL CAVITY IN AN ANTERIOR TOOTH

Even though the cavity was quite shallow, the pulp felt the irritation of the carious process and attempted to shield itself by forming a nodule of secondary dentine on the walls of the pulp chamber. This demonstrates that no cavity is too small to be filled, for even the shallowest cause an irritation of the pulp as soon as the dentine is reached.

existing need. We should adapt our procedures to such issues and come as near to prevention as possible. We should also give up all practices that are not as satisfactory as we hoped they would be.

I think there is no procedure at the present time that will lead us so

definitely to the preservation of teeth, as the operation which has been explained to us this evening. One of the objections which I have not heard any one voice, is that this proposal does not include the environment of the tooth. We have been looking to the environment, and that is one reason why some of us have been slow to accept this procedure. We have been

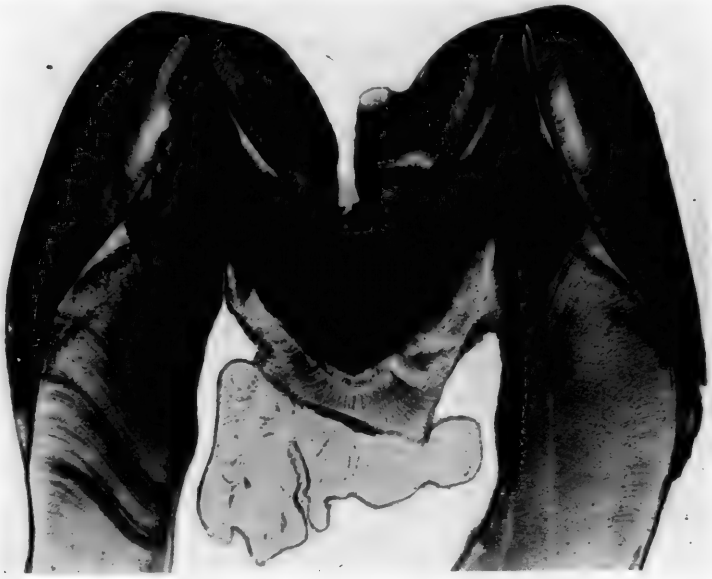

FIG. 19. A CARIOUS MOLAR HAVING AN ENTRANCE AT THE OCCLUSAL SURFACE BARELY FOUR TIMES THE WIDTH OF AN ORDINARY EXPLORER

The carious process has, however, spread laterally in typical fashion, undermining a great amount of the enamel. The pulp has also felt the irritation and shielded itself by the deposition of a large amount of secondary dentine. Such dentine, formed as a result of irritation, is clearly shown in this figure, for we note that the horns of the pulp have shown no such reaction, the irritation having been localized in the more central part of the tooth.

working on the head of the patient, but on the tail of the problem. We have waited until a cavity was large, and sometimes until the whole crown of the tooth had been destroyed, before we attempted to do anything, rather than to examine the structure of the tooth itself. I believe the objections Dr. Hyatt mentioned were handled in a most satisfactory manner, and I think the answers to the objections should satisfy everyone. I agree with

nearly all of the thirteen statements he has given us. There is no doubt about the smaller fillings lasting longer than the larger ones. The durability of fillings is inversely to their size.

Practically all structural loss of molars is due to fissures that were filled too late, or were not filled at all. Less than 1 percent of thirty to forty-year-old molars had no fissures, while 73 percent of approximal cavities began in a pit or fissure. I think this is absolutely true, so that in our clinic we consider that every approximal cavity in primary molars, as well as secondary molars, had its origin in a pit or fissure.

I believe we are thinking too much of environment and not enough of structure. We do not know the origin of the structural faults. I hoped that Dr. Bödecker would tell us something about the origin of these fissures, and perhaps he will do so; but we believe they are concerned with some type of faulty nutrition. I think the time is coming when we shall be able to diagnose an area where a cavity will occur. This may possibly be determined by x-ray or other means, by which we can see some form of breaking down of the tissue; and I think that will approximate preventive odontotomy. You all have seen instances of a large disto-occlusal cavity in the second bicuspid in a child ten or eleven years of age, and the molar normal in appearance without a cavity. This I believe is very good evidence that different conditions prevailed in that child's system when the bicuspid and molar were developed. If that could have been determined before the actual breaking down of the tooth, a small cavity could have been filled rather than a large one. I believe there is no question that something beside the environment of the tooth was concerned in this instance. The contact point was just the same for the molar as for the bicuspid, the acid was probably the same, and the plaques were the same; but the structure was different.

I was very glad to hear what the essayist said regarding the importance of the study of relative immunity, rather than of caries. He suggests that, during the last twenty years, the dental profession has been more interested in caries. I believe *to-day* only a very small proportion of the profession at large is interested in nothing but caries. I recall a meeting of a dental society five or six years ago, at which the late Dr. Bogue was present, and at which the attendance was very small indeed. Dr. Bogue said: "If the subject this evening had been on root-canal work, or crowns and bridges, or in inlays, this room would have been filled." It is certainly inspiring to see such a splendid attendance this evening—to listen to a subject that deals primarily with immunity, rather than with caries.

In the past dentistry has evaluated its service very largely by the extent

of its work. The number of fillings, the number of crowns or bridges, or the sizes of the inlays or fillings, were the basis upon which the service was evaluated. At the infirmary we have attempted a different evaluation—to visualize the end results to the child not by the number of fillings inserted in the teeth, nor by the number needed, nor by the type of dentistry, but by the condition of the teeth at high-school age. To be sure that is not the end of the problem for that child, but it is an approach to a terminal evaluation. In trying to determine whether the plan was successful, I examined a group of approximately one thousand school children in whom dental work had been begun in the first, second, and third grades in school. For some, the work was started when they were first-graders; for another group, as second-graders; for the rest, as third-graders. The divisions were approximately equal. In the ninth grade it was found that 82 per cent of these children had four vital first molars, with nothing but the pit or fissure fillings that had been originally inserted; 11 percent more had three first molars in the same condition. This is not as good as it should be. During this period of ten years the extraction of the first permanent molars has been considerably reduced. Ten years ago one first permanent molar to every three teeth was removed. Last year the number was reduced to one in two hundred, which was accomplished by the early treatment of the sixth-year molars. The one in the two hundred was not a failure, but resulted in children who came from outside districts, or where the work was started at a later period.

A large part of the effort at the clinic has been focused upon getting the treatment started at the earliest possible age. At first the Infirmary cared for children up to the age of sixteen years, and consequently nurses, parents, physicians, and even dentists, thought that the children should wait until they were nearly sixteen before any treatment was instituted. It has taken nearly eight years to correct this false impression. The average age of the children who came for treatment was fifteen and a half years. It is human nature to procrastinate, and it has been a most difficult problem to reduce that age limit. Dentists are most influential, of course, because all of the others look to them for advice, and consequently it is the dentists' responsibility to refer the children for treatment at an early age. Last year we did not register a child over seven years of age.

I was quoted once as saying we did not take young children. We take them as young as two years of age. Children who come regularly for cleaning and examination are seen three times, during their school career, for routine filling. This treatment is instituted as soon as possible after the eruption of the first bicuspid and second molar teeth. The nurses are

instructed to watch for the eruption of these teeth, irrespective of the child's age. Then they are sent to the Infirmary, for cleaning and examination. If any fillings are needed, or if any cervical cavities appear, appointments are made and the fillings inserted. The children are put through the pediatric clinic, which includes strict attention to diet and habits. This plan, I believe, will yield the results we are looking for.

It is my opinion that prophylactic odontotomy and the care of the fissures, soon after the teeth erupt, can be carried out as well in clinics as in private practice. The dentists who are not following this procedure are remiss in their duty to the profession and to the public.

Leuman M. Waugh, D.D.S., F.A.C.D. (*New York City*): I think the Executive Committee should be congratulated on the selection of Dr. Hyatt as the essayist for this evening. I will not attempt to discuss the subject, but should like to read a paragraph of a letter from Dr. Williams. I had invited him to be my guest this evening, but as he has not yet returned from his summer home, he is unable to be with us. Twenty years ago he was the first man to demonstrate the plaque. Dr. Black thought it might exist, but Dr. Williams, by a new use of glycerine instead of balsam, demonstrated it definitely. Years ago I heard him say that he did not believe dental caries ever had its inception except under a dental plaque. The following is the excerpt from Dr. Williams' letter.

"I am much interested in Dr. Hyatt's views on prevention of decay and saving the masticating teeth by anticipation of decay.

"Knowing conditions as they are, regarding the habits of the great majority of people, with reference to the care of the teeth of their children, and the rapidity of the processes of decay in early life, there is just one question, the answer to which, covers the whole ground of Dr. Hyatt's proposition. The question is this; will more teeth be saved by removing one of the greatest predisposing conditions of decay, than by leaving that predisposing condition and taking the chance that the patient will be able and circumspect in attending to the matter at the right time?

"Dr. Hyatt has gathered a vast array of facts, in addition to my own observations on this question, and it is my opinion that millions of teeth would be saved by anticipating decay and insuring against it."

Henry W. Gillett, D.M.D., F.A.C.D. (*New York City*): I wish to express my appreciation of the fight that Dr. Hyatt is making. He did have a fight on his hands in the beginning, but I can see no reason for it, except that the mass of the profession, confusing the terminology, did not consult their dental dictionaries to determine the difference between a fissure and a groove. He is quite correct in regard to the attitude of the dental profes-

sion. For that matter, the same is true of the medical profession. Through many decades, the members of each branch of the healing art have been concentrating upon pathology, and have only recently been talking about preventive dentistry or preventive medicine.

I cannot resist reference to an interesting experience during the month of September. I was in the Southwest in two different archaeological locations, having occasion to view the skulls and teeth of what remained of the pre-historic age in that district. That is a very vague remark—"the pre-historic age." The archaeologist estimated that some of the remains dated from 600 A.D., while the earliest remains that I saw excavated may even go back to 2000 B.C. In one of the localities I was surprised to find plenty of evidence of every type of pathology we have to deal with to-day. In the other locality all of the usual pathology was represented except mal-occlusion. At Pecos 25 to 35 percent of the cases showed distinct evidence of pronounced mal-occlusion. I was not prepared for that in so primitive a race. There was a great difference in this respect between Pecos and the other location, which is about 300 miles southwest of it, and cut off very largely from contact with adjacent districts because of mountain ranges that surround it. In the second location (Swarts Ranch in the Mimbres Valley), I did not see a single case of mal-occlusion; but 30 or 35 miles away, in another valley contributory to the same water-shed, I was assured by the archaeologist in charge that, if I had come eight or ten days earlier, I would have seen plenty of cases, but they had all been boxed up and sent away.

It is interesting, in connection with our subject, to report the marked prevalence of such fissures as Dr. Hyatt has been talking about. Many skulls were those of children, among whom there was a heavy mortality, as would naturally be expected under the primitive conditions of life. I collected many teeth of different ages, and a number of jaws with teeth in the early stages of development; also a goodly number of loose first and second molars. Frequently we were able to recover only a few teeth from some of the skeletons, and they were in all stages of development. A large percentage showed distinct occlusal fissures, proving that tooth calcification under prehistoric conditions in those districts was no better than at present, if as good.

I want to refer at some length to one of Dr. Hyatt's statements, and to divide my remarks into two sections. He questions our clinical procedures for the discovery of fissures, or for the discovery of open fissures. Dr. Bödecker's pictures suggested one section of my comment. He showed, with his slides, the shadow of an explorer, but of one that is most unsuitable

in a test for fissures. The dental manufacturers do not make suitable explorers for such work. The explorer should not be over one-third the diameter of the one Dr. Bödecker illustrated. During all of my professional life, I have had explorers made specially for that purpose, and even then I frequently ground them flat so they would penetrate better. You cannot get from the supply houses an exploring instrument that is fit for examining the occlusal surfaces of a child's teeth. This is a dogmatic statement, but I will take it back when you show me the instrument that disproves it.

Dr. Bödecker's slides showed how far the evidence of disturbances reaching the dentine through these open fissures could be traced, he also indicated how he distinguished between the stains of caries and the other stains or discolorations, which he says are due to the technique of making the slides. It was my good fortune, while in New Mexico to confer with Dr. Howard Raper, who, now at Albuquerque, is just beginning to struggle back to health sufficiently to do a little work in his specialty of radiology. Many of you know that good radiograms, if studied with care, will show the early stages of caries. I do not know whether we can use the radiogram effectually in the detection of fissures, but Dr. Raper showed me striking instances of the discovery of obscurely located caries, and I commend his special films to your attention. With Raper's films, which may be obtained from the Eastman Company, it is possible, in five exposures, to examine the crowns of all of the teeth and of the crests of the alveoli. I hope that Dr. Bödecker will determine whether those stains show, radiographically, in the crowns of teeth where it is certain there are open fissures. If he finds they do, he will have an excellent check on their presence where he suspected they may be, but could not prove it by an instrumental examination.

William D. Tracy, D.D.S., F.A.C.D. (*New York City*): There are so many points of interest in Dr. Hyatt's paper that all of us might discuss it; but I believe, Dr. Hyatt, when the literature is reviewed in later years, you will get more laurels than you may expect to-day, because time seems to put a different perspective on things. I am sure that what Dr. Hyatt has shown will lead us to save more teeth than we have ever done before.

I regret that nothing has been said about the technique. Of course that part of it appeals to those of us who are in active practice. Some use nitrate of silver; some, copper cements; others, tin and gold, gold fillings, and amalgam fillings. It is just a question of what seems to be the best procedure.

Dr. Hyatt has endeavored to get the endorsement of dental societies to a resolution which considers it unprofessional not to do this work, and unprofessional to neglect small cavities in children's teeth. Some societies ac-

cepted the resolution and others did not. Some took the ground that, if the resolution were adopted, and if a dentist overlooked a small cavity in a child, the parents would have cause for redress.

Many cases of caries have their origin in fissures. Working in a fissure cavity, you may find that it leads into an approximal cavity; but it is not my idea that *all* approximal cavities originate in a defective fissure.

Dr. Gillett: It was my pleasure to offer the motion that Dr. Hyatt's resolution be adopted by the First District Society, and if he has it with him to-night I should be glad to offer it here.

Dr. Hyatt: The motion to which Dr. Gillett and Dr. Tracy allude differs from the resolution I had hoped to present to-night. The former motion was worded as follows:

"Resolved: That the filling of initial cavities is a moral duty to our patients, and an obligation of our profession."

I asked for the adoption of such a resolution because many of the employees of the Metropolitan Life Insurance Company told us that their dentists said that they should wait until small cavities became larger to have them filled. When I requested the adoption of this resolution by the Second District Dental Society, one member objected, stating he believed that it was quite possible, with a patient who came regularly to watch such a place carefully and to catch it before it became too large. Another member, who frankly thought I exaggerated the whole situation, happened to serve with the Oral Hygiene Committee in an examination of the children in the Brooklyn Erasmus High School. The children were given slips marked with the location of cavities, and told to have these teeth attended to. Six months later we made another examination of these children, to find which had received the proper attention. It so happened that about half-a-dozen children, whom this dentist had examined, came under his hand again. He found that many of the cavities marked by him had not been filled, and that each of these children had a letter from his or her dentist stating that all of the necessary work had been completed. When questioned, the children said their dentists told them the cavities were too small to be filled. This dentist then came to me and said: "Hyatt, I take it all back. This is a most deplorable state of affairs. I marked only places where there could be no question as to cavities that needed filling."

All I am contending for is the treatment or filling of all fissures and pits before decay can start. If I can emphasize the importance of this; if I can

show the logic of this procedure; if I can prove from figures that practically all fissures and pits decay; and if I can show the dangers in the possibility that decay increases without any external evidence then, perhaps, more men in our profession will be willing to cut out these pits and fissures before decay can be seen.

I believe the time has come when organizations of professional men should proclaim the procedures they believe to be good practice. That is why I drew up these resolutions; but when President Palmer requested me not to bring them forward to-night, I did not do so. The resolution which I hope will be adopted by your Society and other dental organizations relates to the early treatment of pits, fissures, and deep narrow grooves. As to interproximal cavities, I do not believe we find many in the early eruption of the teeth. The interproximal cavities are not largely involved in children's work.

J. Lowe Young, D.D.S., F.A.C.D. (*New York City*): For twenty years, in working for children and before adjusting appliances, it has always been my practice carefully to examine all surfaces for the detection of any existing cavities. I think it will interest Dr. Hyatt to learn that in many cases I have sent children back to their dentists three times, before I could have all the cavities filled. I make it a rule not to put on appliances when there are any unfilled cavities. I have not insisted on the filling of fissures that appeared to be non-carious, but I believe it is sound practice to do so. Wherever a fine explorer catches in a fissure, I consider that a cavity. I have seen fillings of tin and gold, in the occlusal surfaces of molars and premolars, that were not a millimeter in width, but they went to the end of the fissures. Those teeth were saved from big, wide-open cavities. If that kind of work were done as a routine, there would not be one-tenth the present call for gold inlays. The orthodontists treat children, and see such things more frequently than the general practitioner. I agree with Dr. Hyatt and Dr. Gillett, that the great difficulty in Dr. Hyatt's first presentation of this question was the terminology—the profession confused grooves with fissures.

Dr. Bödecker showed a beautiful slide of the short cusps and shallow sulcus with a slight fissure. It would seem that a fissure of that type could be ground out sufficiently to make it self-cleansing; but in the other type, the very large ones, there is only one hope, and that is to cut them out. The picture which Dr. Bödecker showed, illustrating decay spreading at the junction of the enamel and the dentine, brought to my mind a boy who, thirty years ago, came to me complaining of pain in a lower molar. After

a careful examination I could not find a thing the matter with the tooth. He came back complaining, and I searched again with a little finer explorer, but still could find no defect. I determined, however, to go into that tooth, which I did. There was so much decay underneath that I had to use great care not to expose the pulp.

These are the things that have to be obviated, and can be eliminated, if you follow the procedure Dr. Hyatt has described.

Dr. Bödecker: Dr. Gillett criticised the explorer. In the picture it showed up exceedingly large, and you could only see the extreme point of it. The enlargement was approximately 25 to 30 diameters, which means that the point was enlarged 1375 times, and it looked like a broomstick. I put it in purposely, to bring to your mind the relation between the instruments which we consider fine, and the dental fissure.

What Dr. Gillett introduced regarding the discovery of incipient caries by means of the x-ray is very interesting. My brother and I brought out before the American Dental Society of Europe, either in 1911 or 1912, an x-ray film-holder with a bite-plate to picture the crowns of the upper and lower teeth. I think you will find it described in the Proceedings of the following year, published in the *Dental Review*.

The stain which Dr. Gillett speaks of, as showing incipient caries, is entirely different in an x-ray film as compared with a photomicrograph. The dark area on a film is due to removal of the mineral salts (by the lactic acid). In approximal surfaces it is very easy to see this. If films are examined with any degree of exactness, these incipient areas will be found.

Dr. Gillett: Before I offer the resolution referred to by Dr. Hyatt, I would be very glad to see any explorers, that any dental manufacturers make, that meet my idea of what an explorer should be. I do not believe the *form* of the explorer shown is right, regardless of its size.

I have one question concerning this resolution: One of the words that Dr. Hyatt uses is not quite clear. What is meant by a deep, narrow groove?

Dr. Hyatt: Just what Dr. Bödecker showed. In some grooves the explorer will not stick, but they are so narrow and so deep that no child can keep them perfectly clean—I have been able to scrape out food debris even after the child has used a toothbrush. Prophylactic odontotomy means the cutting of the tooth for the prevention of decay. It does not mean that you have to cut a cavity into a tooth. In my office when we find deep, narrow grooves that do not go half-way down through the enamel,

I take a fine-cut finishing bur and open up these grooves so that they are practically self-cleansing, or are easily kept clean with a brush.

I have not offered any technique, because I have wanted to emphasize the point that something should be done to these pits and fissures, even though they do not show any caries. Since presenting my first paper, I have added the deep, narrow groove. I want my friends who are interested, and who believe that this procedure will prevent the loss of a great many teeth, to work out a technique that will be acceptable to all. I have felt that if anyone disagreed with my technique he might not appreciate the main idea, which is to take care of non-carious pits, fissures, and deep narrow grooves by any conservative technique which he can best use, and which in his hands will best save the teeth.

It has been my effort to try and prove that something should be done to these fissures before decay starts. In 99 cases out of 100 they will decay, and you can never tell when it will start. Something should be done to make this occlusal surface immune, and which will not permit the active factor of decay to operate.

Dr. Gillett: In my estimation, an open fissure is a potential cavity, and there can be little distinction between its treatment as soon as found, and its treatment a little later when the decay has actually begun. If there is any difference the advantage is all on the side of the earliest possible attention. If I were in practice, I should want some leeway on the deep, narrow grooves, that of the privilege of watching them. If I could get no evidence that the apparent groove was really a fissure, I would prefer the untouched enamel surface rather than the roughened surface that results from any instrumental interference.

Dr. Young: Is that not a deep, narrow groove?

Dr. Bödecker: Yes.

Dr. Young: I think a distinction should be made between a groove and a fissure.

S. E. Davenport, M.D.S., D.D.S. (*New York City*): I think I should do myself an injustice if I did not offer a word of protest. We should be satisfied with the process of education which has been so well started to-night. I do not object to the body of the resolution, or what it means, but the uncertainty of just what it means is shown by the various suggestions of these

gentlemen, and we have as many definitions for fissures, grooves, or symptoms of disintegration as men present. It is self-evident that it is our duty to follow our best ideas in the preservation of teeth. I admit that, in the past, most of us old fellows paid too little attention to prevention, and too much to preservation. We have, however, attended as far as possible to preservation, and are not quite in harmony with the present great destruction of teeth that is suggested by slight shadows. We cannot be made moral by legislation. While I do not object especially to the passage of the resolution, why tie ourselves up to this language, which is so hurriedly fixed for us, although it is done by some of our best "fixers"? What good will it do us, as an Academy, to adopt any one particular measurement of our duty, when the human element is behind each one of us? We might as well pass a resolution to be honest, sincere, and conscientious. I think this resolution in this body is a silly thing.

Dr. W. D. Tracy: I got a different reaction to this resolution. It is not what good it will do the Academy, but what good it will do the instigator of the movement, if we endorse it? Without seeming self-satisfied, I might say I do not think we, in this Academy, need the resolution.

Dr. Gillett: I want to modify that phraseology. It is not what good we can do to Dr. Hyatt, but what help we can give dentists who are not recognizing, or not doing, their whole duty. In view of what Dr. Davenport said, and recognizing the force and correctness of the thought back of his view, I would say this: a fissure is a definite thing, and I doubt if the dentists of New York State know the distinction between a fissure and a groove. Some of you will get a different idea of the matter if you look up, in Black's Anatomy and Anthony's dictionary, the significance of the difference.

I suggest that this resolution have appended to it, as a foot-note, Black's definition of a fissure. I will include that in my original resolution.

M. C. Tracy, D.D.S. (*New York City*): I move that this matter be referred to the Board of Governors, for a report at a subsequent meeting.

W. B. Dunning, D.D.S. (*New York City*): I second what Dr. Davenport said. I approve of everything that Dr. Hyatt stated, but I think it is a mistake for us, as an Academy, to hamper individual judgment. A resolution of this kind is apt to have an unfortunate effect. I appreciate the importance of educational propaganda along these lines, but I think it can be done more effectively in other ways. As Dr. Davenport said very

wisely, we cannot conduct our professional life and our professional procedures by legislation.

R. W. Waddell, D.D.S. (*New York City*): We cannot plead ignorance of these faulty fissures, but it seems to me that the resolution is faulty and incomplete, inasmuch as it suggests that "operative procedure is indicated" without giving an adopted technique. I believe a lack of technique is responsible for the failure of the general practice of this procedure, for nothing is more arduous or more difficult than opening up sensitive fissures in the teeth of small children who will not tolerate it; and after the fissures are opened, we have no definite idea what to do next. We must put on the rubber dam, and after we sterilize the dentine, what will we put in it?

Bissell B. Palmer, Jr., D.D.S. (*New York City*): It seems to me that prophylactic odontotomy is either a very good procedure or a dangerous one. If it is a step ahead, the profession should back it solidly. If it is dangerous, the profession should condemn it. Even though this resolution may be passed by a majority, I think that, if there is any opposition to it, it should not be passed at all. Any value of such a resolution would be lost by even mild opposition. It was my original thought, early this evening, that this resolution should not be presented, because I believed Dr. Hyatt would gain almost as much if the resolution were signed by the representative men who have approved the doctrine of prophylactic odontotomy.

Dr. Hyatt: I believe that when a dental organization goes on record as indorsing a procedure, its action has a strong influence on the rank and file of the profession, because the idea then becomes impersonal. The final judgment of a professional organization, after careful and matured consideration has been given to a subject, is impressive.

Dr. M. C. Tracy: I am not opposed to the idea of prophylactic odontotomy. I am greatly in sympathy with Dr. Hyatt's efforts to prevent decay in children's teeth, but I think we should consider it further before adopting it this evening.

S. E. Davenport, Jr., D.M.D. (*New York City*): I have a suggestion to make before we vote on this matter. If the word "operative" were changed to "protective procedure," would that make any difference? To some "operative" may mean an extensive procedure. It has been my practice to fill the deep, narrow grooves with oxyphosphate cement, without cutting

them out, when there has been apparently no evidence of decay. If I had not been here to-night and heard this discussion, the words "operative prodecure," to me, would mean cutting them out and filling them to the end.

Dr. Dunning: The whole subject is so debatable that while we are in the main in favor of it, it would be wise to take a little time to consider it.

Dr. Gillett: If Dr. Tracy's motion means that the matter will be taken up and considered, I would be in favor of the same.

Dr. Hyatt (*in conclusion*): I want to thank you, Mr. President, and through you all of the members of the Academy, for extending to me this opportunity to discuss this problem with men whom I have known for many years. My most intimate friends in dentistry are here to-night. While I thoroughly agree with Dr. Davenport that we cannot legislate morals into men, we can at least show them what is right; that is, what we consider is the right thing to do. Whether they do it or not is another matter.

THE RELATIVE ADVANTAGES OF AMALGAM AND GOLD INLAY FOR THE RESTORATION OF TOOTH STRUCTURE IN POSTERIOR TEETH[1]

A Debate

WILLIAM R. POND, D.D.S., AND HENRY W. GILLETT, D.M.D., F.A.C.D.

Rutland, Vermont *New York City*

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I. THE ADVANTAGES OF AMALGAM AS A MEANS OF RESTORING TOOTH STRUCTURE OF POSTERIOR TEETH

William R. Pond, D.D.S.

Judgment is an important factor in the selection of filling materials and is worthy of discussion. No one material is best for all cases. Our patients should have the benefit not only of operative skill but of good judgment, which is the result of knowledge gained by experience, as to which filling material will serve best in the individual case. The man who becomes a faddist and uses any one material for all fillings does not manifest good judgment, even though he may become extremely proficient in the manipulation of that material. I would dislike to be thought of as an amalgam operator who uses this material because of lack of ability to use any other, and I am sure Dr. Gillett would resent the implication that his work was confined to gold inlays for the same reason. Both filling materials are satisfactory when used as indicated, and proper judgment requires that the operator be equally well trained in the use of both amalgam and the gold inlay.

[1] These papers were contributions to a debate at a meeting of the New York Academy of Dentistry, New York City, November 24, 1925.

That posterior teeth should be restored with metal fillings whenever possible, is an axiom upon which we can all agree. There is no other material which will restore tooth form and function in such a permanent way. If we agree with the above statement, we have the choice of two filling materials: gold and amalgam. Gold-foil fillings have a most definite and useful place in dentistry, and I believe there is a just revival of interest in their use; but, in discussing the restoration of posterior teeth, and large fillings particularly, I believe that the gold inlay is the logical choice of the gold restorations. What an easy thing it is to become enthusiastic about the gold inlay! What beautiful restorations they make when done well. Clinics on gold inlays are always welcome, and what a good standing it gives the individual who sponsors them. The whole situation is indicative of the exclusive and the high class.

How about the status of the amalgam filling? Quite the reverse in a general way. It would be a conservative statement to say that ten amalgam fillings are inserted to every gold inlay, and yet amalgam technic is given a most inconspicuous place on dental programs and clinics. Few men who value their reputations sponsor the cause, or even risk their standing by being caught in the same room when the subject is being discussed. The whole situation savors of poor and cheap dentistry with which one hesitates to be associated. The foregoing may be an exaggeration now, but it was literally true a few years ago. Never was a bad reputation more justly deserved, never has a filling material been so abused, and never has the profession used a material about which it was so ignorant as amalgam. Amalgam has served the purpose not only of the ignorant and unskillful, but also of the unscrupulous, and has consequently had to pay the penalty. I am glad to say that the situation has improved and that many societies are helping to bring about this improvement. The manufacturers have been more influential in the development of amalgam than have the dentists. They have carried on research in the laboratory, which has resulted in a perfected, standardized, and chemically pure alloy. There has not, however, been a corresponding advancement in the development of a standardized and accepted (and practical) amalgam technic, nor has sufficient effort been made to study the problem clinically. The "value of a long continued clinical

experience" and of "careful clinical observation," as mentioned by Dr. C. N. Johnson, cannot be over emphasized in the study of amalgam. These are two important factors which contribute much to the accumulation of human knowledge. The observations and comparisons which I make are based upon my clinical experience with amalgam.

Amalgam as a filling material is fundamentally sound. It is a wonderful thing to have a plastic metal with which to fill teeth, and few of us fully appreciate this fact. When properly used amalgam is in a class by itself, as it is an almost universal filling material that is capable of remarkable results in restoring lost tooth structure. About one hundred per cent of the profession are using amalgam, and about ten per cent are using it properly. The causes of failure are perfectly obvious, but are worthy of discussion. The principal reason that amalgam restorations are so frequently unsatisfactory is because of the general lack of understanding of the proper technic for the use of this alloy. Poor cavity preparations, poorly adapted matrices (or failure to use a matrix), poor condensation, lack of carving, and improper finishing are among the causes which contribute to the failure. Lack of contact point, poor marginal ridges, and improper occlusion are but the natural outcome of the foregoing. Too often, when comparing gold inlays with amalgam restorations, the ideal inlay is compared with the poorest type of amalgam filling. Of course no comparison is possible. Not all inlays are perfect, but a perfect inlay is a very satisfactory filling. Few amalgam restorations are perfect, but when they are they are equally satisfactory.

In order to make a proper comparison between the results achieved with inlays and amalgam, it is necessary to mention particularly the fact that gold inlays are cemented into place in the tooth. The cement, plus the proper restoration of the missing structure in gold, is what saves the tooth. The same principle applies to amalgam, and these fillings should also be cemented. The amalgam filling is cemented by lining the cavity with soft cement and packing the first of the amalgam into this. All metal fillings should be cemented. A dozen years ago, Dr. C. J. Grieves commended the practice of cementing amalgam, and made the statement that the line of cementation was finer than could be done by the best inlay operators.

The same principle applies to the foil filling. From more than twenty years of clinical experience, I can endorse the practice of cementing amalgam and gold. Do not delude yourselves by thinking that inlays are better tooth savers just because they are made of gold. One can readily see that the tooth saving properties come from cementation and not from the metal itself. The gold inlay makes a splendid reproduction of lost tooth structure and in many cases is the most artistic of restorations, but it will not save teeth better than an equally well introduced amalgam filling, a malleted foil filling cemented, or a porcelain inlay.

If the foregoing step in technic is accepted, it places several filling materials approximately upon equal basis as tooth savers. The selection of a filling material becomes therefore a matter of judgment as to what will best restore the lost tooth structure for the individual case. The matter of judgment in the selection of a filling material is a broad subject, and many things should be taken into consideration. In making a choice between a gold inlay and an amalgam restoration (restoration meaning filling), the age of the patient, the habits of the patient (including environment of teeth), the esthetic value, the type of the teeth, the depth of the cavity, the sensitiveness of the teeth (including a desire to conserve the pulp), and the financial condition of the patient, are all factors which should be considered.

What is the matter with amalgam fillings? Principally, faults in operative technic, all of which could be remedied. The New York State Dental Society's Committee on Research made an investigation of amalgam fillings and reported on "Failures with Amalgam as Commonly Used." One of their findings was the fact that only about ten per cent of amalgam fillings are polished. This ten per cent represents about the number of men who are using amalgam properly. Three steps in technic, I believe, are of great importance, and if observed will do much to raise this percentage and improve the completed filling:

(1) The amalgam should be of the proper consistency and should be properly condensed. If the mix is too dry and is poorly condensed the result is poor contact at the gingivo-approximal margin, which is later manifested by a recurrence of decay. This is known as the "leaky filling" and is destined to failure.

(2) If a well polished, well fitted matrix is used and the filling is properly condensed, the gingivo-approximal margin will be good, and no polishing will be necessary except with fine strips or pumice.

(3) Correct approximal contact can be obtained in the finished filling by previous separation. Heavy pressure in introducing the filling will also give the necessary space for finishing when the matrix is removed.

Why expect amalgam to save teeth under an entirely different operative procedure, and even a different code of ethics, than that employed for other filling materials? Some men have two codes of morals: one for business, one for personal use. It would seem as though dentists employ two codes of ethics: one for gold and one for amalgam.

What is the matter with the gold inlay? Certainly no faults in technic or operative procedure. The chisels, the stones, the disks, in fact all things which make for good operating, are used for this kind of work. Naturally a wonderfully fine technic has been developed for gold inlays and the results are among the finest in operative dentistry. I cannot bring myself to criticize the gold inlay. It is only the judgment of man which is at fault in trying to use the inlay in all restorations, and in so doing condemning all other procedures as wrong. Anything which threatens to become a fad should be investigated. Do not think of amalgam as an inferior filling material that is used only by "cheap" dentists for poor people, and think not of the gold inlay as the criterion of good dentistry. Let us therefore make our comparisons on the basis that both the gold inlay and the amalgam filling have an important place in operative dentistry.

Amalgam is a most satisfactory filling for temporary teeth, and if cemented it can and should be used in nearly all posterior cavities in children. Its advantages over all other fillings for such work seem too obvious to call for discussion. I see no use for inlays in such work. Next for consideration come the first permanent molars. Taken early, it is easy to handle children by doing small fillings with amalgam or gold foil—and how much better it is for these teeth. In badly broken down sixth-year molars it is mostly a case of the operator's choice as to what will save the teeth. The pulps of many of these teeth can be better saved by an immediate filling with amalgam.

The continued irritation from extensive cavity preparation for inlays is contra-indicated in such cases. Many of these teeth have a very feasible preparation for amalgam after the decay is removed, whereas preparation for an inlay requires much more cutting. Amalgam can be cemented into almost any preparation that will hold a cement filling. We have all seen the distressing results of constant irritation caused by large gold inlays in young teeth. Second permanent molars can usually have dental attention before the cavities are of great size. The fissures, in mouths with an ordinary degree of immunity, can be very successfully filled with amalgam or gold foil. After the twelfth year it is possible to arrive at a diagnosis and prognosis of mouth conditions, and as a consequence the practical use of gold inlays becomes more apparent. Bicuspids that require more than fissure fillings at an early age eventually need radically large restorations, for which (for esthetic reasons) the inlay may justly be selected. However, in these teeth, cemented amalgam fillings check decay just as well, and the results are identical.

Many incidences arise which call for the use of good judgment of a very practical nature when selecting filling materials, especially for young mouths. Fissure fillings will do for some, while large extensions into immune areas will be needed for others. The fight will be a losing one in some cases anyway. Molar teeth which decay on the lingual surfaces at an early age have a poor prognosis. I always fill these cavities with amalgam. The prognosis for buccal cavities is a shade better. Inlays are superior in these cases, but equally well executed and well polished amalgam fillings will certainly serve the same practical purpose. Surely inlays are seldom indicated in third molars unless the wisdom tooth happens to occupy the place of the second molar. In a general way we may say that adult mouths are the principal field for inlay work. I believe the large restorations in pulpless teeth are better done with inlays.

Amalgam is, if I may use the term, a more versatile filling than an inlay, and just as good a tooth saver if used with cement. It can be used in any cavity prepared for the inlay and in many variations of cavity preparations where an inlay can not be used. It can be used with a butt or lap-joint preparation at the gingivo-approximal margin. It can be used for pin-point fillings or for large restorations, and, being

a plastic material, it can be used in many difficult places where an inlay would be practically impossible. The gold inlay apparently has a fine enough line of cementation for practical purposes, but it cannot be as closely adapted as a well packed amalgam restoration. Amalgam is not "a poor filling and a filling for the poor" in any broad sense. It will serve the poor if used properly, but no better than the wealthy if badly used. It is not a just thing to say good fillings for the rich, bad fillings for the poor. The magnitude of the subject is evident from the report of a clinic which shows approximately 30,000 amalgam fillings and 75 inlays. If the truth were told at least 50 per cent of all the fillings inserted are amalgam. It is not a case of serving just the poor with amalgam; it is a case of dental service for the mass of the people; people of moderate means; people with large families, who are trying to educate their children and meet their financial obligations; people who have more brains than money; people who are the backbone of the nation. The average individual can have better dental service with amalgam fillings not because it is a cheap material, but because it is a time saver compared with gold and time is the basis of the dentist's fees. You can figure it as you please, but the fact remains that on the average two to four equally good amalgam fillings can be used in the time necessary for one inlay.

Insert all the inlays you can with good judgment. They are beautiful and practical, but do not delude yourselves by thinking that this will solve the problem of good dental service for everyone. In the middle west there are dental societies where, under oath, the members agree to use the rubber dam in all their operations. The man who can organize the dentists, under oath, to do amalgam restorations as carefully as they do gold inlays will be the Moses of dentistry.

Rutland, Vermont.

II. THE ADVANTAGES OF THE GOLD INLAY AS A MEANS OF RESTORING TOOTH STRUCTURE OF POSTERIOR TEETH

Henry W. Gillett, D.M.D., F.A.C.D.

When the new departure creed was launched in 1877, by J. Foster Flagg, with the support of S. B. Palmer and Prof. Henry S. Chase, Article I of their creed read as follows: "In proportion as teeth *need*

saving, gold is the *worst* material to use." The arguments that I shall present to you will be based on a paraphrasing of that famous first article, which I have just quoted. It is this: In proportion as posterior teeth need saving, the cast-gold inlay is the best material to use. Lest the first phrase be deemed ambiguous, let me say that I deem it to mean in proportion as teeth have lost substance by caries

FIG. 1. TWO-PIECE HOLLOW INLAY

Below: amalgam model; *next*, first casting of ductile gold—say, 5 per cent platinized; *top*, second casting of harder gold.

When completed, the two castings are soldered together with a solder of suitable color, in such a manner as to leave the margin of the first casting exposed to permit instrumentation in closing the joint at the margin. Lines indicating cement and line of union of the two metals are intentionally left open for better definition of the technic. The illustration is faulty in not showing a reproduction of the gingival enamel ridge on the longer side.

or otherwise. You will find, however, as I go on, that while I have definite opinions concerning the adaptability of the cast gold inlay for extensive work, I have equally definite opinions concerning its advantages in the case of a great many of the small, or even the very small cavities. You will also find that I am emphatic in my endorsement of the use of cast-gold restorations where so much of the tooth is gone that they may properly be designated as crowns. Even

for the cases requiring the porcelain-jacket crown I shall advocate as routine procedure, the use of cast-gold bands and copes for all pulpless teeth, and even occasionally for vital teeth, giving you what I believe to be sound reasons for this practice.

I wonder if some of you, who know my views concerning the gold inlay, have been smiling inwardly as I developed the above fundamentals. As many of you know, I hold that the cast-gold inlay is not a gold filling at all, but that it is a cover serving to supply an efficient substitute for the missing parts of the tooth. It also seals the real filling, which is the underlying cement, away from the contact of the salivary fluids, and is, in turn, retained in its seat partly by the cement. In other words, our filling is a compound one of two widely differing elements, each of them protecting the other, each of them supplementing the other, and each of them serving a beneficent office impossible for the other one, in the preservation of the usefulness and efficiency of the damaged tooth.

Has it occurred to you that this means the reconciling of the opposing statements of the two first articles of the two creeds of '77, the discussion of which so disrupted the dental organizations of that period? Art. I of the then accepted creed, in distinction from that of the new departure creed, which I have just called to your attention, read as follows: "Gold is the best material with which to save teeth." A large part of the reparative work done by the dentist today endorses as sound the essential principle back of both of these diametrically opposed articles, but not as conceived by the contestants of those earlier decades. While at present, the dental profession does not accept the declaration of the creed of '77, that gold is the worst material to use in contact with cavity surfaces, neither does it endorse the opposite view and accept gold as the best material, because it employs cement in carrying out its most highly specialized efforts to restore carious teeth to usefulness. In the same class of operations, with certain concessions to esthetics in the use of porcelain, the profession demonstrates its belief that no material is as efficient as gold, for protecting the underlying cement from disintegration, and for the insurance of continued health and usefulness, not only of what remains of the tooth itself, but also of the health of the adjacent gingival tissues.

Having laid this much of the foundation, we may go on to consider specific conditions. While especially desiring not to discuss side issues, in order to be clearly understood, it is desirable at this point to introduce a classification of cases suitable for gold restorations. The first class that I want to consider is the badly broken down molar tooth, the tooth in which from half to all of the crown is missing. It is my contention that this is the place where the cast-gold restoration most effectively demonstrates exceptional, even superlative value. For such a broken down tooth, I hold that no other known process equals the gold inlay in permanence of restoration of functional efficiency, in permanence of effective conservation of such sound tooth substance as remains, and in providing an irreducible minimum of the factors tending to foster irritation of the gingival tissues. I need to qualify the term "cast-gold restoration." Such an extensive restoration can seldom be a notable success, unless the advantages of the indirect-inlay system can be utilized in its construction. I am not so radical as to contend that in some fields the direct inlay cannot well serve our purpose; but I do contend that, when we come to this particular class of work, the extensively decayed and broken-down tooth, the direct-system inlay is seldom available because of the mechanical handicaps inherent in its development. Included in this section of our restorative work are the cases in which a porcelain crown is to be used. I am in hearty accord with the tendency of the profession to adopt, as its standard device, the porcelain-jacket crown for pulpless as well as for vital teeth; but I hold that to use it on a pulpless tooth, without a cast-gold cope and band, materially reduces its value in the conservation of root strength and health of gingival tissue.

Next in this arbitrary division of our restorative work we have that large class of cavities which makes up the bulk of all our work in posterior teeth; namely, the proximo-occlusal cavity of varying size. In this field I stand firmly in favor of the superiority of the cast-gold inlay over any now available form of restoration, and in so doing I shall differ radically from some of my close friends for whose opinions I have the highest regard. The cavity preparation I advocate for such restorations usually sacrifices tooth substance which could be retained if amalgam were used, or even if different cavity lines were

adopted. A chief merit of the cast-gold inlay, in this field, is the fact that tooth material which by other filling processes is often retained (to the detriment of an efficient result) may be eliminated and replaced by extensions of the inlay, which are in every way desirable. A further advantage is the fact that removal of enamel at one point makes possible the conservation of more important tissues in other parts, with improvement in retention form.

Coming now to the final division of my arbitrary classification, the small cavity in a posterior tooth, I shall contend for the marked superiority of the cast-gold indirect-process inlay for all accessible bucco-gingival and linguo-gingival cavities, and for the cast inlay, either direct or indirect, for many occlusal cavities. For the occlusal-fissure cavities, I am glad to admit the superiority of two materials now almost disused by the profession; namely, non-cohesive gold foil and the combination of non-cohesive gold foil and tin foil. For some of them, amalgam has so nearly equal efficiency, that its other merits may place it in the front rank.

Before presenting the reasons for my belief in, and advocacy of, the above statements, I want to try to remove from this discussion a fact or which always beclouds any discussion of advanced operative procedure. In such discussions it constantly happens that the issue is confused by lengthy reference to the so-called average operator, and his capacity or incapacity, to carry out one or the other of the methods and procedures under discussion; and frequently, also, by advocacy of the supposedly simpler procedure because it will come within the capacity of a larger number of operators. In discussions concerning standards, before organizations of the calibre of this Academy, such pleas ought to be considered irrelevant. If it be held that such pleas are in order, then I shall meet with flat denial the common contention that differences in the properties of our filling materials are important in their relation to the capacity of different operators. To use the venacular, I hold that the "dub," in making one kind of filling, will be pretty sure to remain a "dub," without regard to whether he handles gold foil, gold inlays, amalgam, silicates, or porcelains. I hold that our problem, in defining standards, is not to simplify the demands merely to compensate the inefficiencies of the operator, but to demand increase in the capacity of operators to such a degree as will enable

them to handle effectively the best available materials for restorations, and for the maintenance of a healthy and efficiently functional masticating organ. I contend that, for most members of the dental profession, there is no sound reason for their remaining in the "dub" class, except laziness, indifference, or a carelessness that amounts to dishonesty. With the many opportunities now available for help in the betterment of operative capacity, no man who produces distinctly poor results with any one of our filling materials is excusable for not realizing his deficiency, or for making another poor filling with it until he has utilized these opportunities.

Even though this be true, it is of course impracticable to suppose that such an idealistic condition can be established as regards a considerable part of the dental profession. Hence we are confronted by a condition analogous to that which the oral-hygiene movement meets in the schools. It is commonly recognized that it is impossible to give every child now of school age efficient oral-hygiene service, and that the only practicable plan is to concentrate upon the lowest grades, and to give to other grades only such help as may be possible after the youngest children have been cared for. In a few years, this course of action will result in a school population with such an improved condition of mouth health that all school children can have adequate attention. I say that the condition is analogous because I have an optimistic attitude towards progress in dental education. I believe the next two decades will bring such advances in the efficiency of dental education, in facility of elimination of the unfit dental student, and in efficiency in building up his professional morale that the percentage of inept dentists will be astonishingly reduced. If there be truth in this forecast, then it becomes doubly important that we concentrate our deliberations, concerning standards of service, upon *superiority* of operative procedures, and not upon their availability for the inadequately trained, lazy, dishonest practitioner.

The above sounds very severe and may be erroneously interpreted to mean that I condemn, in these fields, the selection of any other filling material for *any* reason. This is not the case. I object to endorsing as the *best*, a standard that means less efficiency of result, and I object to compromise in defining standards because inadequate execution may mar the result. I would rather exhort the inefficient to

build up their efficiency and to keep on aiming at the zenith, because too often aiming at the horizon means having one's effort fall dead at one's feet. I recognize that expediency may often dictate a compromise in procedure, but hold it to have no place in formulating a decision as to the best material and best procedure for the protection and conservation of damaged teeth.

Having now set before you the high points of my support of the declaration of my title, we may take up the different sections and study them in detail. The first question for review may well be: Why am I so emphatic in my endorsement of the superiority of the cast-gold inlay, or cast-gold restoration for the badly broken-down tooth?

First, because it enables the operator to conserve all the mechanical strength remaining in the impaired tooth, in so far as this can be done by any process now known to dentistry. This is to be accomplished by careful attention to the requirements of cavity preparation along such lines as shall provide, as an integral part of the finished product, a cast substitute for a band so formed as to be capable of being finished to a thin knife edge. This feature is capable of such handling as practically to exclude risk of splitting the root, which is a constant menace for this class of operations, if band support be absent. This hazard is constant, regardless of whether the principle used for attachment to the tooth be that of dowelling an extension of the restoration itself into the root, or that of added wire dowels or pins, either as supplementary or the main means of establishing attachment of the restoration to the root. Such dowels reduce the risk of breakage, but do not eliminate it to anything like the same degree as is accomplished by the band. The principle of the ferule for the support of the root is so old and so well established that we need only comment upon the superiority of the band so formed. It can be adapted to the tooth at its margin with a closeness of contact, and a nicety of finish, that is approached, I believe, by only one other procedure. If, in the fine steps of porcelain-jacket crown, a platinum matrix can be retained, and trimmed to narrow proportions, this perfection of margin can be practically duplicated, but the strength to resist stress that tends to split the tooth is missing. The conditions of this cast-gold band can be duplicated by using sheet metal of a quality to permit spinning,

re-enforced with a harder gold fused onto its outer surface in such a way as to leave exposed the margin of the band presenting rootwise. This is merely a modification of technique without variation of principle, and would seldom be utilized unless the condition demanded the maximum of strength in the band, which might occasionally be provided by this more complex procedure.

My *second* point in favor of cast-gold restorations is that in providing an overlapping band of the type described, we reduce to a minimum the possibility of irritation of gingival tissues. Intimately related to this is the fact that, in developing the wax pattern of the restoration by the indirect process, it is fairly easy to provide a substitute for the gingival enamel ridge, which is so important in some parts of the tooth for supplying protection for the delicate gingival margin. The safeguarding of the integrity of this margin is one of our most important responsibilities.

Third, because establishment of such a margin, and its proper handling, insure the sealing of the cement from the disintegrating influences of the salivary fluids as perfectly as is possible by any now known feasible procedure, with consequent preservation of the retentive properties of the cement, and of its protective value against recurrent decay. It may be well for me to state again what I have said so many times regarding the overlapping inlay margin, and its mechanical adjustment to the tooth to insure sealing of the cement against salivary fluid influence, as compared with dependence upon the cast-butt joint for the establishment of such sealing. To insure certainty of understanding, I will repeat that I regard the sealing resulting from such a mechanically adjusted margin as much superior and much more reliable than that obtainable with the cast-butt joint. This mechanical adjustment may be brought about either by the spinning of the margin immediately after the inlay or restoration has been seated; or when suitable conditions are present, it may be accomplished by slightly reducing the size of the amalgam model at the point where the inlay margin makes contact with it, then spinning that margin to contact with the modified area of the model. The established marginal form will be forced outwards by the corresponding portion of the tooth itself, when the inlay is carried to its seat.

I regard this second means of insuring snugness of fit of the

margin as the more tricky one to master, and, where the margins are accessible, my common practice has been to spin them to place after placing the inlay. There are, however, two points to be made in favor of establishing this snugness of marginal fit by dressing the model and spinning the margin to contact with the surface so modified previous to setting the inlay. By this means one avoids the possible interference with cement crystallization, which is a theoretical perhaps a practical possibility if the spinning is done after the inlay is placed. There is also, in the particular type of cavity we are now considering a marked advantage in this second form of manipulation in cases where portions of the tooth preparation happen to lie considerably rootwise of the gingival margin. In many of these extensive preparations, there may be, on one or more sides, deep extensions of the cavity rootwise beyond the general level of the preparation. In such regions, it is of the greatest importance that instrumentation that might interfere with the integrity of the vascular tissues be held at the irreducible minimum. In suitable cases, the procedure described above can be utilized to eliminate the need for such instrumentation in these areas.

My *fourth* claim for superiority for the cast gold restoration in these extensive cases rests upon the importance of having a material that can be relied upon to withstand any stress to which it may conceivably be exposed. Literally to realize this last factor, it is frequently necessary to adopt special measures, which I think have never been adequately set forth, although on other occasions I have referred to them, and Dr. Pollock and I have shown the technique at clinics.

For these large restorations, it is quite essential that the margin of the casting be of a gold soft enough to yield readily to mechanical manipulation. In other words, of such quality that its margin can be spun to contact with the tooth, after the inlay has been set, without the exhibition of enough force to risk injury to underlying enamel rods. On the other hand, gold of this quality is not satisfactory for occlusal surfaces. In the cases where a number of such occlusal surfaces are to be restored in one mouth—the typical bite opening case—the requirements for the occlusal surfaces are for a gold entirely unsuited for use at the margin of the restoration, because gold of this character

is scarcely more capable of being spun to a new form than tempered steel would be under the same conditions. To meet these requirements, several steps in technic must be added to the inlay process, but none of these steps are any more difficult to carry out than the steps of the regular procedure, and the superiority of the product amply warrants their use.

Little or no modification of the cavity preparation is called for in making such a restoration. All doubtful tooth material is cut away. A beveled marginal form is provided for the establishment of a generous overlap, with a distinctly marked outline, so that the location of the marginal overlap of the inlay may be readily apparent to the technician. If dowels for security of anchorage are required, they should be fitted before taking the impression. These pins should be of high fusing material. The portions entering the dowel holes in the root should be smooth, without irregularities of any kind. They should be coated with a heavy oil, or with a very thin layer of wax, so as to insure ready removal from the amalgam model. Their occlusal ends should project out of the dowel holes enough to allow the cavity impression material to grasp them firmly, which can be assured if the exposed end of the dowel wire is given a winglike form by squeezing in the joint of a pair of laboratory pliers. The occlusal aspect of such broken-down teeth, need protection, so that all parts of the crown should be shortened till there is at least $\frac{3}{64}$ of an inch of space between it and the opposing teeth when the rest of the teeth are in occlusion.

The taking of the impression, the bite, and the mounting of the models on the articulator for such a case, do not differ from regular routine. The only condition presenting any additional difficulty, is the one where the preparation extends rootwise well beyond the gingival margin. The fitting of the band, to insure a good impression in such a case, often calls for more than ordinarily careful attention. When the band is once well fitted, the other steps follow the normal course. Often such a case may be made simpler by the expedience of taking first an impression of only the deep extension rootwise, and making for it an independent small inlay to bring that part of the preparation up to approximately the general level and setting it in advance of taking the impression for the main inlay.

In the making of a wax pattern for such a cast restoration, a thin layer of wax is formed to cover the surface of the preparation, carefully adjusting its margin to slightly more than cover the externally beveled outline of the preparation on the amalgam model. This casting may approximate an average of $\frac{1}{33}$ or $\frac{3}{64}$ of an inch in thickness, but may be thinner or thicker in parts to meet the requirements of the individual case. If a remaining portion of the tooth approaches very close to the occluding tooth, this first thin casting may have an opening to leave exposed that part of the preparation. It is not material that the central part of the preparation corresponding to the pulp chamber be covered, unless gold is needed there for the attachment of dowel pins. If dowel pins are to be used, and they have come out accurately seated in the impression, then they can be waxed to the pattern, and the thin base can be cast directly to them, with the precaution, in the case of platino-iridium pins, of thoroughly fusing a thin layer of high carat gold upon the surface of that part of them where the gold casting is to attach itself. If there is doubt as to whether the pins have come out accurately seated in the impression, and consequently in a position to be accurately seated in the amalgam model, then holes may be left in the first casting, at the point where the pins are to pass through it. Their relations may be established later in the mouth, and then made secure by soldering.

In forming such a wax pattern, the desired marginal conditions of the finished work must be constantly kept in mind. The very margin of the gold overlap must not be finished too thin at this stage, because it is to go through more mechanical steps than is the case with the inlay of ordinary type. It must be remembered that the finished inlay is to restore the outward flare of the normal tooth at that point, in order to maintain normal tension of gingival tissues. This may mean, in a case where the whole crown of a tooth is to be restored, that all of this flare may be best supplied in the first casting. In occasional instances, it may be desirable to take the first casting to the mouth for checking up with certainty its relation to the tooth and the gingival tissues. After the thin base above described has been cast, it is to be placed accurately in its seat on the model. In the cases where the dowel pins have been attached by soldering, after determining their exact relations in the mouth rather than by their seats in the model,

it is necessary to bear in mind that the dowel holes in the model will need enlarging in order to permit accuracy of seating. The amalgam model, with this first casting, is now to be placed in its proper seat in the articulated plaster models, and on top of the first casting a second wax pattern is carved to complete the form of the restoration desired. Proceed in precisely the same way that you would if you were building the wax pattern on the amalgam model instead of the gold casting, always taking pains to so shape that part approximating the margin as to provide a form that will accurately seat itself on the first gold casting. This, of course, will be facilitated by providing in advance a bevel in the first casting, so that the second casting will have an overlap resembling in its relation to the first casting—the overlap of the latter in its relation to the tooth.

This second wax pattern, having been satisfactorily developed in outward form, may advantageously have the sprue wire firmly attached to it to serve as a handle. Working from the surface which was formed in contact with the first casting, its center should be cut away with wax removers of the Roach type, or with suitable excavators, leaving only a hollow shell of such thickness as may be required for strength. In variation of this technic to provide a hollow shell, build up, on the central portion of the first casting, a cement form approximating the area it is desired to leave open in the second casting, and then perfect the form, at such points as seem desirable, by enlarging the central opening in the wax pattern resulting from this step.

At this point, it is appropriate to refer to preferred metals. For dowel pins, for this and for other conditions, I have had much satisfaction from platino-iridium posts made from specially drawn tubing of appropriate gauges (B & S 14, 15 and 16), in such a way as to have the smallest possible lumen, which should permit the entrance of only 30 or 32-gauge wire. Such a pin can easily, quickly, and safely be drilled out of a root if the need ever arises, and the fact that it is tubular instead of solid does not reduce its strength in any important degree. In order to produce an artistic result, both castings should be of similar color. Some operators prefer the copper alloys for this work, while others like better the less marked contrast with tooth color tones supplied by the platinum or silver alloys. In either case,

alloys with the requisite qualities for the two parts of such a compound restoration, can be readily made in any laboratory where a nitrous-oxide blow-pipe is available, or they can be purchased in the market. In bite-opening cases, where occlusal surfaces of all of the molars and bicuspids of either maxilla or mandible are to be restored, it frequently happens that a very hard gold, one even as hard as Ney-Oro "E" or "F," or the hard clasp golds, may be used for the second casting.

Having completed both castings and established on the casts their relations to adjoining and opposing teeth (the steps of this work should have been done with such accuracy as rarely to require trial in the mouth at this stage), the two castings should then be united to make the completed restoration. For this a solder of a color similar to that of the castings, cut in small pieces, and some form of spring pliers that will hold the two castings closely in contact with each other during the soldering process, are required. If the basal casting is a solid piece, with no opening in its center, a small hole should be drilled through it to serve as an air vent during the soldering process. At one or two points on the outer margin of the area of contact between the two castings enough gold should be ground from one casting or the other to make a convenient ledge for laying the solder. The solder should then be fused and led around the joint until the two castings are completely united, taking pains always to prevent the solder from encroaching upon the extreme margin of the first casting, since a stiffening of this margin would interfere with spinning it to its seat.

This step completed, the restoration should be finished in the ordinary approved manner, and is then ready for setting, except for attention to the open center. This may well be filled with gutta percha, if the omission of some part of the central area of the first casting has left its interior sufficiently accessible. In the case of the first casting that completely covers the root end and is provided only with the small vent hole, a slight reaming on the cavity side permits its sealing with a bit of cement or gutta percha. Both of these procedures avoid inclusion of air under the cement, which is an inconvenience at the time of setting, and tends to unseat the restoration while the cement is plastic, giving rise to the fallacious idea that cement expands in setting. Making such restorations hollow has two

advantages. If made solid, they are unduly heavy. If it happens to come about that it is desirable to remove one of them, such removal is greatly facilitated by the hollowness. A careful execution of the details described results in a restoration of macroscopic anatomy of the tooth capable of secure anchorage to it, with only a minimum of risk of splitting as a result of leverage stress. When properly adapted and finished, it will be found to offer the minimum of irritation of the gingiva, and to supply the maximum of protection for the gingival margin, with the maximum of strength in the restoration itself.

The advantage of casting a complete cope and band, for a porcelain-jacket crown on a pulpless tooth, in addition to the usual core for the support of the latter, hinges upon the superiority of the type of overlapping margin and joint above described in its relation to the gingiva, and the conservation of tooth strength by the inclusion of the band as an integral part of the finished work. That gingival tissues take more kindly to a fused porcelain surface than to the other available materials is a truism. The joint of the porcelain-jacket crown for the posterior tooth presenting at right angles to the gingiva, and its tendency to develop a slight ditch with sharp margins on either side, because of cement solution, is quite another matter, and is frequently the cause of considerable irritation. The thin smooth margin and practically complete obliteration of the cement joint resulting from accurate technic in forming and fitting such a cast band, are most important factors in the conservation of gingival health in such cases. Of course, the superior conservation of strength resulting from utilization of the band needs no comment.

To depart for a moment from the letter of my title, I commend to your attention the utilization of the same principles for porcelain-jacket crowns on anterior teeth. The occasional exposure of a fine line of gold, on the labial surface of such restorations, is more than compensated by the removal of the tendency to irritation at that point, as is the case with the typical porcelain-jacket crown technic.

We will now consider the various sizes of proximo-occlusal and m. o. d. cavities. It is for this class of cavity that probably three-quarters or four-fifths of all cast-gold inlays are made, and it is here that most frequently there is occasion for making choice between the gold inlay and other filling materials. Without the slightest hesita-

tion, I again claim that the advantage in this field lies with the gold inlay because it affords better protection and better conservation of such strength as may be remaining in the crown of the damaged tooth.

By the right selection of gold alloy for a given case, we may provide the requisite variation in hardness for meeting the requirements of the different conditions of stress which present for our consideration. There is considerable difference between the requirements for a young person of delicate physique and those for a vigorous 200 lb. man, with heavily developed jaw muscles which he is in the habit of using vigorously on hard foods. To use, in the first case, the quality of gold requisite for the second, is to invite prompt disaster by the establishment of traumatic occlusion, while to use in the second case gold adapted to the first one can result only in disappointment because of early failure of the inlays.

It is desirable here to consider the principles of cavity preparation, because the answer to the question whether you believe in, and practice, the Black system of cavity preparation for such cavities as we are discussing, will make a great difference in the way my thesis in this division will be received. If extension for prevention fails to commend itself to your judgment, then you may disagree radically with what I am about to bring to your attention. If you subscribe to that principle and practice it in your daily efforts to solve the problems forced upon you by the great number of proximo-occlusal cavities in the mouths of your clientele, then I anticipate being able to make clear to you that the lines of cavity preparation I shall advocate, do not result in sacrifice of important tooth tissue without a corresponding conservation of other more valuable tissue in like or greater amount. I believe you will readily acknowledge that the lines advocated place the margins of the finished work where they are least menaced by recurrent decay.

I do not hesitate to counsel the removal of sound tooth substance when its removal seems to me likely to make possible better conservation of the essential parts remaining. I hold that even though the portion to be removed be considerable in amount, the decision should rest upon the answer to the question whether the parts remaining will be better conserved in durability or in function, or in both these

features, as a result of this removal. Some operators seem to feel that sound enamel must never be removed because nature placed it there, and they are apt to claim that we can never replace it with anything else as good. This is an axiomatic truth when considering a sound tooth. Nature, however, either causes or permits teeth to become diseased, and when the situation reaches such a condition that the removal of part of a damaged tooth, even though it be sound tissue, seems likely to make possible better conservation of the function and integrity of that tooth, I hold it to be the dentist's duty to adopt such a course. Therefore, when a posterior tooth presents with a large proximo-occlusal cavity, in any mouth, or when any such cavity presents in a mouth showing a pronounced tendency to caries, I hold it to be the duty of the operator to place the proximal margins of his finished restoration of missing tissue well within the reach of friction of the tooth brush, and the excursions of food in the process of mastication.

The most effective, the simplest, and the most conservative procedure for accomplishing this is elimination of proximal contour in cavity preparation to a degree that will place the proximal margin of the finished inlay well out on the buccal and palatal or lingual surfaces, and beneath the gingival margin. This will remove a varying amount of sound enamel. In a tooth with a large cavity, it will be only the edges of the side walls and a facet across the cervical region rootwise of the margin. In a cavity of moderate size, it will be a thin slice of enamel; and even if we were considering a sound tooth, this would still describe the amount of tissue to be removed. The doing of this at an early stage of the cavity preparation conserves the time of both operator and patient. Having done it, we then find that in order to carry out the principles of extension for prevention, it is unnecessary to adopt the flaring side walls of the cavity as described by Black, and that they may advantageously be kept practically parallel to each other without the sacrifice of anything of importance.

In the case of a tooth with a very large cavity, this procedure makes little difference in the amount of tooth conserved, but in the case of the moderate and small sized cavity, it results in the conservation of triangular pillars of dentine at the angles formed by the facet resulting from the slicing off of the contour and the lateral walls of the proximal

portion of the cavity. The best estimate that I can make of the amount of this conserved tissue in such cavities, is that it may vary from an amount equal to the enamel sacrificed, to twice or occasionally to three times that amount, when comparison is made between the lines recommended by Black, and those I have just suggested. The proof of the truth of this assertion can best be developed in connection with the slides.

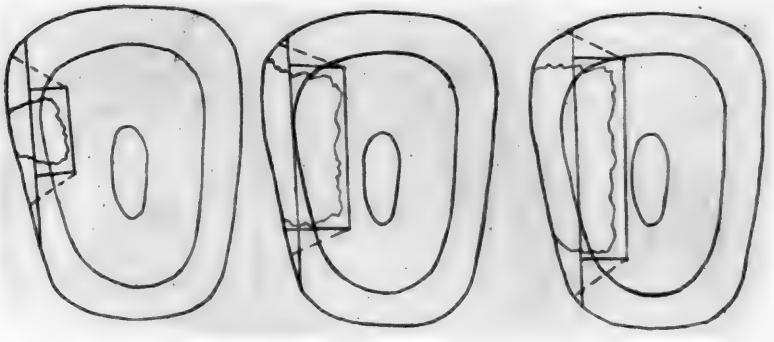

FIG. 2A FIG. 2B FIG. 2C

FIGS. 2A, 2B, and 2C. CROSS SECTION OF A BICUSPID, ROOTWISE OF THE OCCLUSAL STEP OF THE CAVITY, SHOWING THEORETICAL LINES OF TWO CAVITY PREPARATIONS, FOR THREE DIFFERENT SIZED CAVITIES

Irregular line shows outline of caries; dotted lines show lateral walls of cavity preparation ordinarily figured in text books, where "extension for prevention" is practised. Solid lines show cavity preparation where removal of contour is practised, and that but little more enamel is removed than by the flaring lines of an ordinary preparation, while a triangular pillar of dentin on the lateral walls enclosed between the dotted line, and the two solid lines of the advocated preparation, is retained (if it has not been removed by caries.)

It is my contention that this very important advantage of automatic placement of the inlay margin in the most desirable location on the tooth, is one which the cast inlay does not share with any other filling material at our command, because no other material that we use for fillings has the requisite physical qualities to meet the requirements. Incidentally, this cavity form is the one that lends itself most easily and with least risk of injury to the tooth tissue remaining, and to such

manipulation as tends to close completely the joint at the margin. Hence it results in complete exclusion of mouth fluids from contact with the cement. Such an inlay provides the best protection for cavities of this class of any variety of filling the profession has ever adopted. First, we have the cement, in contact with the whole interior surface of the cavity, capable by proper manipulation of being so increased in amount at desired points as to protect the sensitive and vital parts of the involved tooth from thermal shock. Secondly, we have the gold casting capable of doing all that any

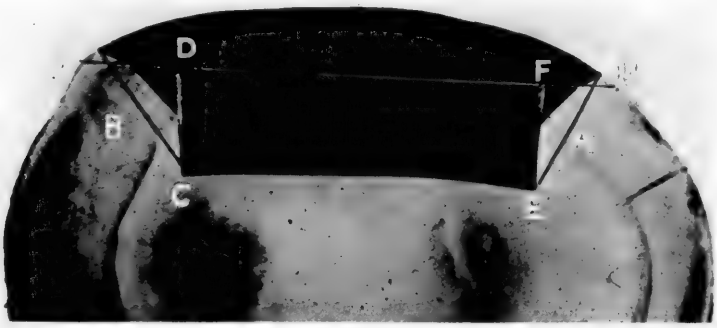

FIG. 3. REPRODUCTION OF AN ILLUSTRATION FROM BLACK'S OPERATIVE DENTISTRY, SHOWING A CROSS SECTION OF A BICUSPID, WITH FILLING IN PLACE; LINES ADDED

Note that the lines A and B, which correspond to those shown also in *fig. 2*, and which are also found in some of Black's own illustrations, result in the removal of more tooth structure than either of the other two plans under consideration; that the original Black preparation conserves more of the teeth substance; and that the lines C-D, E and F, and G-H, which I have advocated in this paper, conserve still more tooth substance, although taking away very little additional enamel at the margin of the preparation.

material at our command can do in the way of accurate restoration of tooth anatomy. It restores efficiency to widely differing classes of cases as regards the stress and wear involved, presenting the necessary quality of hardness accompanied by both ductility and toughness. It is capable of such mechanical handling as results in a practically unsurpassable smoothness of joint, and also in effective protection of the cement from destructive action.

I think it will be well to make clear, at this point, part of my position concerning one of the advantages that may be claimed by Dr. Pond

for amalgam in this class of cavities. He will probably hold that an amalgam filling for such cavities can be more quickly made, and consequently will cost less. I do not know how strongly he will stress

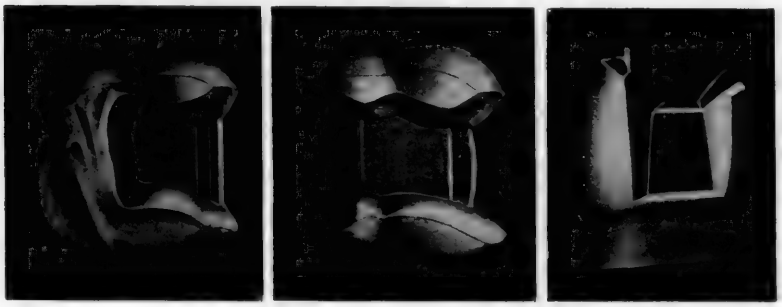

FIG. 4A FIG. 4B FIG. 4C

FIGS. 4A, 4B, and 4C. ILLUSTRATIONS FROM THE LAST EDITION OF THE AMERICAN SYSTEM OF DENTISTRY, SHOWING CAVITY PREPARATION AS TAUGHT

Note the flaring side walls

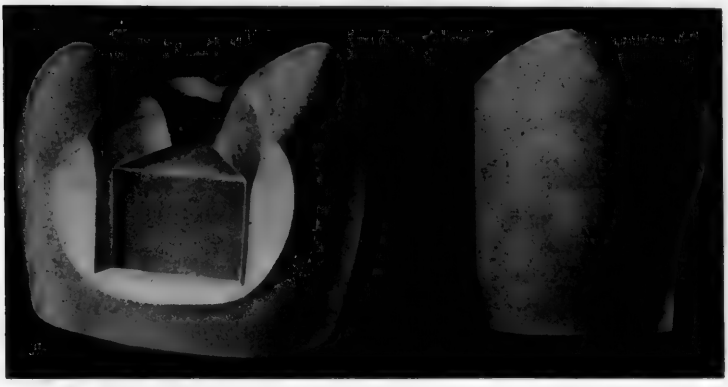

FIG. 5A FIG. 5B

FIGS. 5A AND 5B. VIEW OF CLASS II INLAY CAVITY PREPARATION, ADVOCATED IN THIS PAPER

Angle of pulpal and axial wall should have been bevelled; side walls flare more than is necessary.

Fig. 5B. Buccal view of same tooth.

this point, but the stronger he makes his claim, the easier it will be for me to demonstrate that there is doubt as to its entire correctness. I shall set off against his claim the obvious fact that, if the inlay cavity preparation be done along the lines I have indicated, namely, quick establishment of outline form by removal of proximal contour, then the time consumed in cavity preparation is not likely to differ much; and, in my estimation, the cavity preparation for the inlay will often occupy the shorter time. The fitting of a matrix, placing

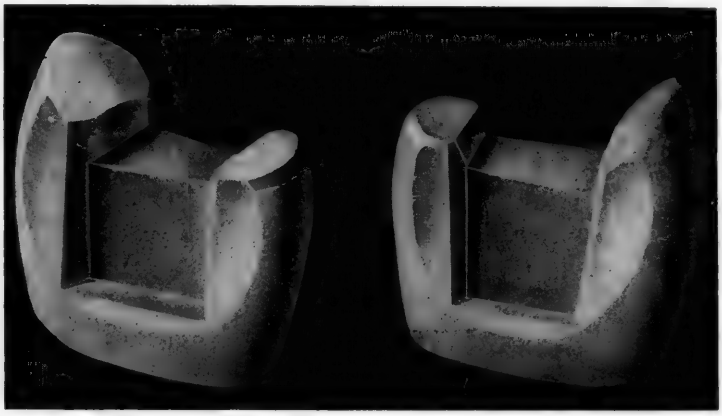

FIG. 6A FIG. 6B

FIGS. 6A AND 6B. VIEW OF M.O.D. CAVITY PREPARATION IN WEAKENED PULPLESS BICUSPID

Angles of pulpal and axial walls should be bevelled.
Fig. 6B. View of same tooth, opposite side.

of the amalgam effectively, and the very careful packing, which I am confident he will recommend, surely require as much time as the taking of a cavity impression and bite—and *frequently* a good deal more. The setting of the inlay should not take more time than the proper polishing of an amalgam filling of this class, and the inlay process does not call for preliminary wedging, which is always a nuisance to the operator, and an aggravation to the patient. We now have left, on the debit side of the inlay, the technic work at the bench, at the hands of an assistant. The actual bench time for an

average inlay of this class is about an hour, so that the value of the assistant's time for the period involved, plus the difference in cost of the material used, and the share of the overheads in laboratory administration chargeable to the inlay, make up the extra price paid for the superior service and conservation values, and for the elimination of the wedge from the process.

Now for a few words concerning the inlay for the simpler cavities. Wherever a cavity on the buccal, lingual, or palatal surface of a molar or bicuspid tooth is so placed that the use of gold is not forbidden for esthetic reasons, and also so placed as to be accessible for the taking of cavity impressions, I strongly favor the use of the indirect cast inlay, even for the small cavity. My reason is, that it frequently minimizes the removal of tooth tissue in cavity preparation, because on buccal surfaces, where there may be one, two, or more points presenting fairly deep decay, there is frequently a surrounding area of very shallow decay. In such cases the cutting out of the points of deeper decay, so as to leave parallel walls—the mere grinding off of the superficial decay to such a degree as to permit of a well defined outline of the amount of tissue removed—enables one to make an inlay in which the portion of gold entering the deeper parts of the preparation serves to hold in place an overlay of gold that joins them together and replaces the rest of the missing tissue. I think I am correct in saying that this procedure is not feasible with any other available filling material.

My chief reason for setting a very high value on the indirect gold inlay in these locations is the fact that it can be completely and very smoothly finished while seated in the amalgam model before it is set. This is a result of much value to the patient. It eliminates the hazard of gum injury while finishing a filling, and it provides a condition likely to be less irritating to the vascular tissues in contact with it than any other that the profession is now able to supply.

I can look back upon buccal fillings made with gold foil, by my own hands and by others, in connection with which the finishing processes did permanent damage to the gingival tissue. I can look back upon other cases in which the relations of amalgam filling to the gingiva was such that the finishing process caused disturbance of the vascular tissues, and the amalgam did not remain smooth, sometimes because

the margin gave away and in some mouths because of a progressive surface disintegration.

In occlusal surfaces, my choice of the inlay would be dictated by the greater certainty of continued marginal perfection; and the larger the cavity, the greater the importance for this factor. This leaves, therefore, only smaller occlusal cavities, the occasionally inaccessible cavity, cavities of repair around other fillings not damaged enough to call for their replacement, and cavities in deciduous molars, as about the only cavities in posterior teeth for which I would not claim superior advantages for the gold inlay as compared with other filling materials.

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III. DISCUSSION

Dr. Pond: In certain mouths, the so-called Black cavity preparation is just as ideal for amalgam as it is for gold. Several times, when I proposed amalgam, I have taken occasion to advocate the Black cavity preparation, and have used some of the illustrations from Dr. Black's book for this purpose. When that "new departure creed" was first announced, remember that all operations were then contact operations—gold was in contact with the tooth structure, and also amalgam—and it was claimed by many that under such conditions amalgam had better tooth-saving properties. It actually seems so in some cases.

I agree with Dr. Gillett that huge restorations for pulpless teeth are perhaps better done with gold. I make some big restorations with amalgam; but, if it were not a matter of money consideration and time, I think it would be a more artistic piece of work, to say the least, to do it in gold. In regard to time, I have been interested in letters received from some young men in the profession. One in particular, who is teaching in one of the schools, tells me he cannot resort to gold restorations in the locality where he is practising, because it takes too much time; and he believes he can do better with amalgam.

It has been said that amalgam properly condensed has the strength of structural steel. Let us take that for what it may be worth, but in my experience it has all the strength that is needed in the mouth. As for the pitting of the surfaces: I think that would indicate an improper mix, and perhaps not the right proportions.

Dr. Gillett spoke about the better tolerance of gold by the soft tissues of the mouth. My own observation is that amalgam is better tolerated, due to its silver content, silver being a strong antiseptic. I would like to ask if anybody knows of any other metal which can be retained under the gum in huge masses for years as well as amalgam. I marvel sometimes at the tolerance. I believe many of the amalgam fillings that extend under the gum could be beautifully polished. Amalgam is a little softer than gold. Amalgam fillings can be polished with cuttle-fish disks, and then with rubber disks, both of which work well under the free margin of the gum. Amalgam, when it is properly inserted and correctly finished and polished, is splendidly tolerated.

I agree with all Dr. Gillett says about the "dubs." We do have to allow for them, and I think they will eventually be eliminated from the profession, because there will be no place for them.

As to the progress of dental education: I am very sanguine, particularly about the amalgam, because once upon a time most amalgam fillings were a terrible thing to see; but recently there has been a great improvement, and a better technique is being taught. The young men are carving their fillings, and developing a better mental attitude toward amalgam work. I see these young men as they come along, and I know this to be true because I have been a member of the Vermont State Board of Dental Examiners for the past ten years. I am very much pleased to see that the amalgam work is improving year by year.

Dr. Gillett: My reading of Dr. Pond's excellent support of the title of his paper brought to my mind two occasions on which I expressed myself with care concerning the comparative values of gold inlays and amalgam in the restoration of tooth tissue lost through caries. The first of these occasions was the meeting of the New York State Dental Society, in May 1910, where I discussed a paper by the late Dr. Safford G. Perry, which was comparable in some ways to Dr. Pond's. Again, in 1913, I presented before a Section of the First District Dental Society of the State of New York, and later before other societies, a paper aimed to refute and disprove the statements of Dr. H. L. Wheeler concerning the superior value of amalgam, as compared with gold inlays, for the restoration of badly broken down molars.

A review of my statements on those occasions satisfies me that I cannot improve upon their phraseology, and I feel that a few quotations from the paper prepared in 1913 will be apropos in this discussion, and will set before you adequately my views concerning amalgam and its use as a filling

material. (These are given below.) In general terms, I agree with nearly everything Dr. Pond has said, and will briefly note here such exceptions as I desire to take.

I think you will find much of what I shall say strongly confirmative of Dr. Pond's estimate of the value and serviceability of amalgam. My first exception is to the quoted statement from Dr. C. J. Grieves that, in cementing amalgam, the line of cementation is finer than it can be made by the best inlay operator. I accept that as probably true only in the case of the inlay with butt joint, and hope to prove, at some later date, that it is untrue concerning the inlay with overlapping joint plus effective instrumentation.

I hold that the gold inlay will save teeth better than an equally well introduced amalgam filling in all of our larger restorations, and in many of moderate size, which are exposed to occlusal stress. I base this opinion upon the physical differences between the two materials. Before the gold inlay was introduced, I made numerous restorations of badly broken down molars with amalgam, and in many instances I found it unequal to the task assigned it. It broke down under heavy stress, and its margins failed because of brittleness inherent to its structure. I am not convinced that amalgam can be used satisfactorily with a lap joint, nor do I see much value in a lap joint of a material as brittle, and frequently more brittle than, the tissue it is desired to protect.

Concerning Dr. Pond's denunciation of the reasons for "failures with amalgam as commonly used," I have only praise, and I have already expressed myself with emphasis concerning the operators who so misuse their opportunities for service.

Dr. Pond has supplied some additions to my list of places where amalgam may preferably be used, which I accept as legitimate. I do not entirely agree with his inclusion of the third molar in the list. Admitting that some third molars are more amenable to amalgam treatment, I would prefer to go on record as believing that many of them are so important in their functions as to call for the utmost limit in service in safeguarding them. In my own practice, there were numerous instances in which I felt the gold inlay was indicated for the effective preservation of third molars.

One of the weaknesses of amalgam is the fact that no one has yet demonstrated a feasible procedure by which the cervical enamel ridge may be restored with it. I am constrained to admit that only a small percentage of inlay operators today improve their opportunity to utilize this property of the inlay, but it is only by calling attention to the fact that it exists that we can emphasize its value. As a profession, we are beginning to have a

definite realization of the importance of the gingival margin, and to study measures for its protection. In the case of badly broken-down molar and bicuspid teeth, it is highly important that normal tooth form be restored in the cervical region as well as on the occlusal surface. If I were to return to a practice where the difference in merchandise cost of filling materials was a factor, I should feel constrained to investigate the possibilities of lower-cost castable alloys as substitutes for gold in the case of very large restorations, because of the better protection of the gingival margin that is attainable by the use of cast metal as contrasted with amalgam.

I am inclined to feel that the reason for the use of amalgam most commonly advanced in such discussions, that of expediency to fit the patient's pocketbook or his desires, is frequently overworked. I admit its force in dictating the selection of amalgam in many instances, but I am sure my experience as a city practitioner was not different from that of others similarly situated. I found, frequently, that individuals who had received inadequate service with amalgam were receptive to well balanced information concerning the better service they would receive from other materials, and that they were willing to pay the price for that better service. Not only that, but often they would travel hundreds of miles in order to obtain such service, because they found the practitioners of towns and small cities failing to co-operate with them in their desire for it. Human nature is so constituted that it is only by preaching and aiming at the super-ideal that we reach the ideal. Likewise it is only by preaching and aiming for the ideal that we reach practical and efficient service. Those whose direct aim is practical and efficient service are apt to attain only mediocrity, while those who aim at mediocrity—or, as they would term it, average or ordinary results—usually make a most woeful exhibit when the sum total of professional effort is reviewed. Therefore, it has always seemed to me wise to urge and to stimulate attainment of the highest possible results, feeling sure that the personal equation, if I may be permitted so incongruous an expression, will do all the toning down that is necessary.

In the following quotations, you will find me on record ten and fifteen years ago, as agreeing heartily with many of Dr. Pond's contentions.

"Before beginning my remarks, as applied directly to the paper I am discussing, I want to make the summing up for amalgam that I have made for the gold inlay. I want it to be borne in mind that when I speak of amalgam fillings, or amalgam restorations, I am thinking of conditions where the cavity has been thoroughly and conscientiously prepared, decayed tissue has all been removed, where margins have been cut back to sound territory, where forethought has been taken as to the relations of those margins to the occlusal stress, where the amalgam has been handled according to the rules laid down

in accordance with the findings of scientific research, and where all the precautions conducing to the best possible result have been observed in the handling of the material in the steps of mixing, introducing and finishing.

"I have no use whatever, nor do I feel that there is any legitimate place in the ranks of our profession today, for the man who inserts occluso-approximal fillings without the use of the matrix, who fails to contour them in such a manner as to leave correct approximal contact, who leaves overhanging amalgam margins, who fails to fit himself to carve, and does not carve to the best of his ability, occlusal surfaces, normal in shape to the case in hand. I feel exactly the same about the man who turns off gold inlays that lack approximal contact, present poor margins, absence of contour and of proper occlusal relations.

"I want to recall to the memory of some of you the fact that in discussing a paper by the late lamented S. G. Perry, before a meeting of the Dental Society of the State of New York, in May, 1910, in which he brought out some points which bear resemblance to those made by Dr. Wheeler, I made this statement:

" 'I have the feeling that we are going to swing around the circle as Dr. Perry has hinted, and, after a few years, shall be giving amalgam more recognition than during the last five or six years.'

"I further remember making the statement at that time that, just so long as there are practitioners who observe the rules laid down by Dr. Perry for the handling of amalgam, amalgam would be found useful and valuable as a filling material.

"The present attitude of the profession, and the present realization that we have not been, in past generations, developing the highest possibilities of amalgam, is an interesting fact, when considered in its relation to that swinging around the circle to which Dr. Perry referred.

"I have not made this comparison without knowledge of my subject (I am not so many years older than Dr. Wheeler), but I am enough older to have been making in broken down molars just such restorations as he describes, before he began practice, and I continued to use them until the gold inlay provided me with a better method for restoring such teeth to efficient service and a more certain means of conserving the strength remaining to them. I took off one of them last winter that had done approximately 25 years service, and I believe I could today, with a cast gold restoration, meet the same conditions, without any more expenditure of time, less stress on the patient, and greatly increased efficiency and durability of the restoration.

"What I have to say for amalgam is this: it is a most excellent filling material, and must continue to be so considered as long as dentists use it in such a way as to bring out its best points. With our advancing knowledge of its possibilities in occlusal restoration, it has become of more value to us than to previous generations. When used as Dr. Wheeler has advised, every precaution taken to safeguard its strong points, and to eliminate and compensate its weak ones, and when care, skill and effort are expended in reproducing with it occlusal surfaces efficient for mastication, it is, in my estimation, second as a filling material only to the well planned and well made gold inlay; and superior to the foil filling in cavities largely involving occlusal surfaces. To accomplish all this, however, calls for the same order of skill and devotion to the ideal as is necessary in dealing with inlays, or idealism in any department of our work. The man who can do it can equally well train himself to do the best in any line, and the young man who will do it, and do no other type of work, is likely to find himself later on in a position to select his patients from those who demand the very best, and stand ready to pay him for it, at his own valuation.

"I have heard the plea made that only the very best, in material as well as workmanship, should ever be used; but to this also I would take exception. Just as it is correct and proper for the man with the lean purse to be content with the cheaper house, the cheaper motor, the cheaper suit, and the cheaper wooden leg, if he needs one; so is it correct for him to be content, and correct for his advisor to recommend the material for his fillings that will give him the greatest proportionate value for his money; and very often, under the present conditions of practice, this material will be amalgam. In order to use it, however, with a clear conscience, the professional man must earnestly endeavor to get from it every time the limit of its efficiency. When he does this, then may he hold up his head unabashed in any discussion involving restoration of lost tooth tissue.

"It is my belief that when he has reached this point he will usually have gone far enough in the consideration of other processes to realize that there is a better way of restoring broken down molars, and that he will desire to use that method where it is possible." [I will add now that if he takes careful account of all time and costs he will sometimes find that such an amalgam restoration has cost him as much in time, effort, and money as an equally carefully made gold casting for the same case.]

I have said on the platform more than once that amalgam serves more patients and more dentists than any other filling material; also that it would be the one we would retain, if we were compelled to discard all but one of our filling materials.

I would sum up the situation thus: where extensive restoration of molar teeth is needed, cast gold has qualities placing it in a position of preeminence, and it is the material to be selected in most cases, if the utmost in service and protection is demanded. Amalgam is an excellent filling material, if wisely and efficiently used. Modifying conditions and expediency often dictate its selection as the material that better satisfies all of the requirements for a given case.

Dr. Pond (in conclusion): When you consider the fact that a tremendous number of amalgam fillings are inserted, and probably always will be, it seems to me there is no branch of dentistry that needs so much encouragement and so much missionary work. This is my main reason for talking about amalgam. Some one said to-night: "Well, you do put in gold inlays, don't you?" I want to say that Dr. W. D. Tracy taught me to put in gold inlays, and I believe mine imitate his fairly well.

Further, I wish to speak of a case which recently came under my observation, and from which several practical lessons may be learned. Eight years ago, when the patient first came to me, she was studying in New York to be a nurse. Her teeth were then in a good state of preservation and almost every tooth was perfect. She had a broken central incisor, upon which I placed a procelain-jacket crown. She had slight caries in a superior bicuspid which needed filling; otherwise she seemed to have a relatively good

immunity. However, during an interval of five years, she had not consulted a dentist and had neglected her teeth. She married meanwhile and had two babies, one of whom was nursing three years ago when she returned to me. Her time was extremely limited, and probably her money too, and it may be five years before she is able to consult a dentist again. At this examination there was extensive caries. Every tooth from the third molar to the cuspid in the mandible had developed extensive cavities. She was a very nervous woman and a difficult patient for me to attempt such an extensive restorative program. It did not require much judgment in this case to decide that amalgam was the filling material of choice. I made a manbidular injection on one side, prepared all the cavities that I could, and inserted amalgam. The next time I saw the patient I carried out the same procedure on the other side. It is my contention that this was the best possible service I could render this patient.

STUDIES IN THE ETIOLOGY OF APPROXIMAL AND GINGIVAL CARIES[1]

JOHN OPPIE McCALL, A.B., D.D.S., F.A.A.P., F.A.C.D.

New York City

The history of the study of dental caries is also a history of the study and research into its causes. Man has ever been prone to ask "why," as he has been confronted with the various phenomena of Nature. And so, he has not been content to repair the ravages of caries but has sought out the reasons for its incidence, with a view to controlling it by preventive measures. The ancients thought that a worm gained entrance to the tooth and destroyed it. With more exact methods of study, this theory was discarded and others were propounded—some fantastic, others having some claim to reason. The inflammatory theory, the theory of electric currents, the vitalistic theory, and finally the acid theory, were successively ushered upon the stage. Of these we find the vitalistic theory and the theory of acid production surviving, each with modifications, to the present day. Thru all this study, however, there has been a somewhat striking failure to enlarge on the various types of cavities, especially as regards their probable etiology. Differentiation there has been, but it has been chiefly along the lines of morphological classification.

The nearest approach which we have to a classification based on etiology, is Black's division into "pit-and-fissure" cavities, and "smooth-surface" cavities, with a subdivision of "superficial enamel decay" and "senile caries." Further consideration of the subject from this standpoint reveals the inadequacy of this classification. To be sure, "pit-and-fissure" cavities are in a class quite by themselves, as regards their probable etiology. All other types, however, are smooth-surface cavities. Their very evident differences from each other can only be explained on a basis of a difference in etiology, a

[1] Read at a meeting of the Pathodontia Section of the First District Dental Society of the State of New York, at the New York Academy of Medicine, March 11, 1926.

difference which is not satisfactorily accounted for in all cases by the explanation of the so-called unclean area.

Let us consider these cavities first, according to their location. We find that the common sites of smooth-surface cavities are the approximal surfaces, the gingival third of labial and buccal surfaces, and the gingival third of lingual surfaces. The "pit-and-fissure" cavities occur on those surfaces which are subject to anatomical defects, as, for instance, the occlusal surfaces of the posterior teeth. While the "pit-and-fissure" class of cavity is not mentioned in the title of this paper, its etiology should receive some consideration, since this may furnish part of the background for the study of the etiology of other types of cavities. The outstanding and obvious feature of these cavities is that they have their origin in fissures which form an ideal lodging-place for acid-producing bacteria and for the pabulum from which these bacteria may produce acid. That acid so produced is the exciting cause of caries is universally acknowledged and may safely be accepted as a fact. The shape of the typical fissure renders cleansing an impossibility and would seem to make caries inevitable wherever such fissures occur. If acid alone caused caries, we should find one hundred per cent of fissures involved in the process. The action of a sole cause would in such locations admit of no exceptions. I do not wish to minimize the importance of the anatomical form of the fissure in this type of caries, nor do I wish these remarks to be taken as an argument against prophylactic odontotomy as a routine procedure. But, from the standpoint of etiology, it is important that we appreciate the fact that a small percentage of teeth having fissures do not develop cavities therein. The student of etiology must seek the cause of these exceptions, since this may prove to be a factor influencing immunity in other types of cavity.

Since the anatomical form of the fissure makes it an ideal place for bacterial proliferation and consequent acid formation, the reason for immunity in even a small percentage of cases, must be sought in some element which provides for neutralization of the acids formed. The only natural external means of neutralization is thru the alkaline salts present in the saliva, and since the penetration of the fissures by diffusion of saliva must be relatively slight, it would seem that we are thrown back rather sharply on an internal defensive mechanism for

an explanation of immunity. This involves the consideration of the so-called vitalistic theory. According to this theory, there resides within the tooth a certain ability to resist the destructive action of caries-producing organisms. Regarded in the beginning as a biologic phenomenon in the broad sense, it is now apparently considered to be largely chemical in its essentials. Both biologic and chemical elements, however, are probably involved. To this complex defensive agency, I applied the term "caries-resistance" in a paper on this subject read before the Preventive Dentistry Section of the First District Society, a year ago.

The chemical part of caries-resistance, as already intimated, is concerned with the neutralization of acids, inasmuch as the first stage in caries is usually considered to be decalcification by acid. This neutralization on surfaces readily accessible to saliva can be accomplished thru the medium of the alkaline salts found in this secretion. In the fissure, it must be accomplished thru the medium of an osmotic circulation in the dentin originating in the pulp. That such osmotic flow is possible, should be clear to anyone who studies the structure of the dentin, with the abundant anastomoses of its tubuli. What is required, of course, is a sufficient ultimate supply of alkaline salts in the blood stream.

As to the biologic aspect of caries-resistance, the evidence is furnished chiefly thru the visible changes found in teeth that have been attacked by caries, but in which the disease is progressing slowly. Microscopic examination shows constructive changes in the dentin between the carious cavity and the pulp, which are evidently of a defensive character. These changes consist of a partial obliteration of the dentinal tubuli, or in other words, condensation of the dentin, and the formation of secondary dentin. The ability of the tooth so to protect itself is evidently due to some systemic condition, whose basis may be conceded to lie largely in nutrition. Whatever its source, this biologic defense, together with the ability to neutralize acids is undoubtedly of systemic origin. It probably plays a larger part in immunity to caries, in the fissures, than on smooth surfaces, although undoubtedly potent in these locations, but will receive relatively little attention in this paper.

Leaving the "pit-and-fissure" cavities, we come to the "smooth-

surface" cavities, and find that these cavities are supposed to occur as the result of acid formation under the protective influence of the gelatinoid, or perhaps better, the mucoid plaque. In other words, it is assumed that these cavities occur only where there is an opportunity for the mucoid plaque to form.

It will be clear, in reviewing the proposed classification of the types of caries, that in some of the locations in which caries is initiated, the opportunity for the formation of the mucoid plaque is either lacking or is present in but slight degree. With reference to the gingival third of labial and buccal surfaces, it may be successfully argued that the excursion of the food bolus is insufficient to scour them effectively, and that, because of this, plaque formation takes place. This may be granted. But this theory does not account for the appearance of caries on these surfaces, in mouths in which the toothbrush is used with obvious success. On the other hand, if this theory were correct; namely, that the gingival third of the labial surface is an unclean area, it should also be true that this gingival third should invariably develop caries in the uncared-for mouth. This is not the case. All of us are familiar with the mouths of individuals who have a high degree of immunity to caries and who give their teeth little personal care. In these mouths, the gingival third of the labial and buccal surfaces will usually be found to be as clean as any other surface of their teeth, despite the failure of the food bolus to scour it.

We have for long been told of the wondrous provision of Nature by which the interdental gingival papilla protects the approximal surface of the tooth from damaging extraneous influences. If this means anything at all, it should mean that this surface will be free from plaque formation when the interdental gingival tissue occupies its normal position. And, it is probable that this is true. It, nevertheless, is equally true that approximal caries has its starting point on that portion of the approximal surface which lies just cervically of the contact point and at the crest of the interdental papilla. The point of actual incidence of caries on this surface is in many cases covered by gingival tissue at the time of incidence. And, it is only after caries has progressed to an appreciable extent that the gingival tissue begins to recede, and plaque formation as it is usually understood, begins to take place.

The point which should be made here is that the mucoid or bacterial or gelatinoid plaque, while it may be an accessory in the causation of caries, is apparently not the factor of prime importance in the process. What we wish to know is what has caused the formation of the plaque, and still more what causes caries in the absence of plaque formation. The theory which is here submitted for your consideration may be designated as the theory of localized acidity. According to this theory, *the more or less continuous production of acid from whatever source, in a restricted locus, will result in either superficial decalcification of enamel, or will in itself promote the proliferation of bacteria that are capable of producing the mucoid plaque.* If we approach the problem from this angle, we can at once account for the difference in the physical characteristics of caries, usually denominated as superficial enamel decay, on the one hand, and penetrating caries on the other. The former is typical of those portions of the labial surfaces on which no plaque can be demonstrated and on which we nevertheless find chalky and pitted enamel. The latter is typified by the approximal cavity, in which the enamel is rapidly penetrated in an area of limited diameter, with subsequent mushroom-like involvement of the underlying dentine.

It should be evident that what concerns us is the initial source of the acid. Fermentation of food particles in a neglected mouth will not sufficiently explain this in all cases. Our interest in discovering the source of this acid should be heightened by the fact that the most distressing ravages of caries frequently occur in those mouths which receive the most scrupulous personal care. We must approach this problem with a mind open to the consideration of any possible source of acidity. Let us consider, then, the possible sources of acid. They may be summed up under saliva, fermentation of food particles, by-products of mucoid plaque formation, and perverted exudate from the gingival crevice. The first of these, namely, saliva, has been the subject of investigation for many years. The consensus of opinion, as expressed even so recently as in the paper by L. R. Gans (Experimental Study in Salivary Reaction), which appeared in the *Journal of the American Dental Association* for February, 1926, is that the reaction of normal saliva is very faintly acid, the degree of acidity being so slight, however, as to be virtually neutral. The important

thing about the reaction of saliva, is that it shows such slight variation under what would appear to be widely differing conditions. In other words, the plain inference to be drawn from investigations such as those of Gans is that saliva may be safely excluded as a possible source of acidity, such as would be capable of producing decalcification. Of the fermentation of food, particularly carbohyrates, as a source of acidity, we may say much, provided it can be demonstrated that surfaces subject to decalcification are habitually coated with fermenting material. As stated earlier in this paper, such opportunity for fermentation is frequently found, but, on the other hand, decalcification also takes place where, in the initial stages at least, there has been no accumulation of food particles. The mucoid plaque, as a holding medium for acid producing bacteria, has also been discussed, but does not serve as a universal explanation of decalcification.

We then come to the possible acidity of localized fluid exudate. The particular locus in which perversion may commonly occur is the tissue comprising the marginal gingiva. This structure forms, by its apposition with the enamel, a crevice, one of whose walls consists of mucous membrane. From this membrane, there is constantly exuded a serous fluid whose exact composition is unknown, but which is evidently in large part a transudation from the blood. When the gingival tissue is in a state of health, it may be assumed that this exudate will have the same reaction as does the blood; namely, alkaline. In disease the tissues are inflamed, and in inflammation we frequently find an acid reaction, presumably due to the abnormal manner of the breaking down of tissue elements. This acidity will be communicated to the blood transudation, and may be demonstrated by appropriate tests made at the gingival margin. Let it be said at once that there is no implication that this perverted exudation from inflamed gingival tissue will necessarily of itself reach a degree of acidity so high as to be capable of producing decalcification. It is, nevertheless, frequently of sufficient concentration to cause the tooth surface to become sensitive in the immediate vicinity of the gingival crest. This phenomenon has been frequently attributed to acidity, and has been successfully treated by applications of various alkaline substances. But the source of the acid producing

this sensitiveness has not been traced to the fluid exuded from the gingival crevice.

The thought which I wish to present to you is not the causation of caries by an acid exudation, but the thought of an abnormal proliferation of acid forming bacteria in the immediate vicinity of the gingival crest, such proliferation being directly favored by the mildly acid exudate from this tissue. This statement is based on the observation that Bacillus acidophilus is capable of proliferating in a medium of decided acidity. A further support for this view is furnished by the observation that bacteria inhabiting the mouth and throat do not thrive in an alkaline medium. Whether decalcification is due to the acidity of the exudate from the gingival crevice, or bacteria which proliferates in this acid fluid, it seems probable that the initial source of the acid and therefore the exciting cause of the decalcification, lies in a departure from health of the marginal gingiva.

It will probably be urged at this point that in many of the cases in which gingival caries is to be seen, the gingival tissue is in a state of health. The actuality of this state of health is frequently open to question, even when the coloration of the gingiva is quite within the normal range. Box has shown that in the early stages of gingival inflammation there may be considerable migration of blood cells into the affected part, and even ulceration may occur on a minute scale without giving any clinical evidence of this disease process. At a later stage, slight symptoms of congestion at the gingival crest may be seen by the careful observer. These signs are readily overlooked, and for that reason we find statements made that the gingival tissue in these cases is in a state of health, when this may not actually be the case. Stillman, makes the statement, however, that, in cases showing superficial enamel decay, he has invariably found recognizable evidence of gingival inflammation. A similar statement might be made regarding the apparent health of gingival tissue which has begun to recede from its normal position at the neck of the tooth. Such tissue is frequently pink in color and of firm texture, and thus misleads the observer as to its exact condition. Box has shown, however, that this condition is definitely inflammatory. Here, too, we may find a source of acidity. And the sensitiveness of the neck

of the tooth, so common in cases of recession, is an indication of the acid character of the exudate from this tissue. It should be emphasized then, that gingival tissue showing even the slightest abnormality of either form or color is to be considered a potential source of acid.

Gingival inflammation may be the result of the action of various agencies, and these have been the subject of much study. Much effort has been expended in the attempt to show that systemic abberations produce gingival inflammation. These efforts have not been crowned with success. On the other hand, local agencies such as calculus, edges of fillings, etc., are well recognized causes of gingival inflammation. Less obvious, and therefore less generally accepted, is the theory that traumatic occlusion causes gingival inflammation. In the strict sense of the word, inflammation may not be caused by traumatic occlusion, but this agency does produce abnormalities in the local circulation and thus leads directly to inflammation. If this is so, we can at once understand how a localized congestion may be caused by traumatic occlusion and may become the source of a perverted blood transudation. The process, however, is not so simple as is here indicated. No sooner does congestion occur than the defenses of the tissues against the ever-present bacteria are broken down and infection ensues. We have, therefore, almost at the outset a complex disease process which may often present considerable microscopic evidence of disease, with little or no evidence of inflammation discernible by the naked eye. In other words, the gingival tissue may show little or no redness, and little or no swelling and yet under the microscope may give evidence of well-established inflammatory change.

The significance of this as regards caries lies in the fact that when tissue injury occurs, no matter what its source, inflammation ensues and the fluid of the part tends to become more or less acid in reaction. An outstanding example is a burn. Here the production of acid may not be obvious. But it is readily predicated by reason of the fact that many acceptable remedies for burns are alkaline in character. In throat inflammation, it may not be easy to establish the fact of acidity, but it is a well-recognized fact that alkaline applications are the most soothing and efficacious. The prescription of an alkaline

gargle is common practice among specialists in this field. The inference should be obvious. It has seemed reasonable to suppose, therefore, that in gingival inflammation the exudate from the gingival crevice is acid in reaction. Sensitiveness at the neck of a tooth, particularly on the labial surface is common, and in the type of case of which we are speaking is usually attributed to acidity. It is often observed where the visible evidence of inflammation is slight or altogether lacking.

This theory of acidity has been held for many years and is exemplified in the practice of treating such sensitive spots by ant-acid applications. It is only the thought of the source of the acid as being in the gingival inflammation which is presented as something new. As said before, these sensitive spots and also their frequent accompaniment, superficial enamel decay, are often to be found on surfaces which seem to have been kept exquisitely clean by the toothbrush, and on which it would seem impossible that mucoid plaques had formed. If such production of acid on labial surfaces can be traced to traumatic occlusion, it would seem reasonable to suppose that quite as much acid may be formed in the gingival crevice of the approximal surfaces owing to the same cause: traumatic occlusion. To be sure, the patient seldom complains of sensitiveness on these surfaces, but this may be due to the fact that no foreign substance touches these surfaces to excite the symptom of pain. The production of acid in such locations, whether thru the agency of traumatic occlusion or not, has been difficult to determine. Indicators used for this purpose in the past have been unsatisfactory. This is due in the first place to the peculiar chemical characteristics of the mouth fluids and in the second place to the difficulty of obtaining an indication with so minute an amount of acid as would be found around the neck of any one tooth.

Phenolphthalein has been used and then discarded as being unsuited as an indicator for this purpose. Yet this chemical has the quality, possessed by no other indicator, of giving a very sharp color change with very small amounts of acid or alkali. However, it was obviously necessary to overcome its inherent faults, if any satisfaction was to be obtained by its use in this field. These faults are briefly, that it changes color in a slightly alkaline medium, therefore

giving an indication of acid when the material to be tested may be faintly alkaline. It is affected by carbon dioxide, and does not react well in the presence of ammonia. Since it has been determined that the saliva is normally faintly acid, it would seem impossible to secure satisfactory results by the use of the alkaline compound. If, however, we use a solution of phenolphthalein which has been made alkaline to a known extent, an acid solution of corresponding strength will just serve to bring it to the point of color change. By experiment, it has been found possible to produce an alkaline salt of phenolphthalein which will be decolorized by an acidity greater than the normal, and which will retain its color if the acidity is within normal range. The problem of carbon dioxide which is present in all mouth fluids, was more difficult to solve and cannot be said to be completely solved as yet. It has been found, however, that some compounds of phenolphthalein are less sensitive to carbon dioxide than others, notably that produced by the action of sodium sulphide. This compound, which is alkaline in reaction, may be used to alkalinize phenolphthalein. It produces a salt of a deeper red color than is produced by sodium hydroxide.

Phenolphthalein itself is readily soluble in alcohol, almost insoluble in water. The alcoholic solution is unsuitable for use as an indicator, especially for solutions in which the acid or alkali is in very weak concentration. On the other hand, the alkaline salts are soluble in water, and are more satisfactory for use in testing the extremely dilute acid solutions found around the teeth. The method of testing which I have finally adopted is based on the use of an absorbent paper, saturated with an alkalinized alcoholic solution of phenolphthalein and permitted to dry. This paper may be cut into strips of convenient size and used much in the manner of litmus paper. The formula of the solution used to prepare the test paper is as follows:

℞ Phenolphthalein.....Grs. I
Alcohol.....℥ LX
Sodi Sulphide Sol.....℥ V

The sodium sulphide solution has the following formula:

℞ Sodium Sulphide.....Grs. XX
Aqua.....℥ i

When test paper prepared as above is brought into contact with the fluid at the neck of a sound tooth having a gingival tissue showing the highest degree of health, it will retain its deep red color, except that a slight fading may be observed at the extreme edge of the paper. If, on the other hand, there is even a slight inflammation of the gingival tissue in the region being tested, a more pronounced bleaching effect will be seen. When passed into a pus pocket, bleaching takes place in proportion to the degree of inflammation. Exposure to air after testing causes bleaching of any part of the paper which has been moistened. Observation must be made as soon as the test is taken. The paper must be kept in an air-tight container. I realize, of course, that the manner of testing here described is not accurate to the extent that it will reliably record minute variations from the normal hydrogen ion concentration of the fluids around the teeth. I feel confident, however, that, because of its relatively slight sensitiveness to carbon dioxide, it is more dependable than phenolphthalein solutions previously used. Certainly as a means of comparing reactions in different places in the same mouth, under identical conditions, it has possibilities of providing data of sufficient accuracy to have scientific value.

In the paper on this subject that I read last year, I reported results of tests made by the use of phenolphthalein alkalinized with sodium hydroxide. The tests were made in the interdental spaces of teeth that, in the radiogram, showed minute approximal cavities and which also gave evidence of being subjected to traumatic occlusion. In these cases the teeth that showed the effect of traumatic occlusion also gave evidence of acidity, particularly as compared with teeth in other parts of the mouth which had no traumatic occlusion. An objection to attributing this indication of acidity to gingival inflammation induced by traumatic occlusion was that even a minute cavity could contain enough fermenting food particles to produce the acid reaction. My present effort, therefore, has been to test the reaction around teeth showing traumatic occlusion with or without a visible gingival inflammation, but without caries. Here it has been almost constantly found that these areas gave an indication of acidity, but that areas showing no inflammation and a reasonably clean tooth surface had an alkaline reaction. This, of course, raises the point

as to why there has been no caries in the presence of this acid. Here we must again refer to the element of caries-resistance, which is partly chemical and partly biologic. This is a point which needs further study. There is in it probably also the element of structural integrity of the enamel or, in other words, the matter of how the enamel was originally laid down.

In this connection, it is interesting to study the possible causes of so-called senile decay. The cavities so designated typically occur at the cemento-enamel junction when this has been exposed by recession of the gingival tissue. This commonly occurs on teeth whose enamel has previously been immune to attack. It seems clear that we have in these cases the combination of a site especially favoring the concentration of an acid fluid and a concomitant lowering of the element of caries-resistance, due to infirmities and nutritional imbalance. The coincidence between a long continued gingival inflammation with the accompanying recession and the occurrence of these cavities is very striking. It is, of course, true that with this recession, an opportunity is created for plaque formation. It is, however, significant that when caries begins, it does not start on the part of the enamel first exposed and longest subject to this plaque formation; namely, the coronal portion of the approximal surface, but on that part most recently exposed and subject for a shorter time to the supposed destructive influence of the plaque.

When we return to the consideration of the cases showing approximal caries at an early age, on surfaces completely covered by the interdental gingival papilla, we are confronted with the necessity of accounting for these cavities by a combination of acid formation due to gingival inflammation brought about by traumatic occlusion plus inferior caries resistance, and possible inferior enamel structure.

By way of confirming the hypothesis herein stated, it would be valuable to fill the approximal cavities in young patients to which reference has been made, without correction of the traumatic occlusion. If these cases were then tested as before, and still found to give an acid reaction, the hypothesis proposed in this paper would seem to have been materially strengthened. These tests have not as yet been made, but it is my hope that they may be carried out in the future, in which case they will be duly reported.

121 East 60th Street

FACTORS THAT INFLUENCE MOUTH CONDITIONS DURING PREGNANCY[1]

JEWELL M. GOMPERTZ, D.D.S.

Director of the Prenatal Dental Clinic, School of Medicine, Yale University

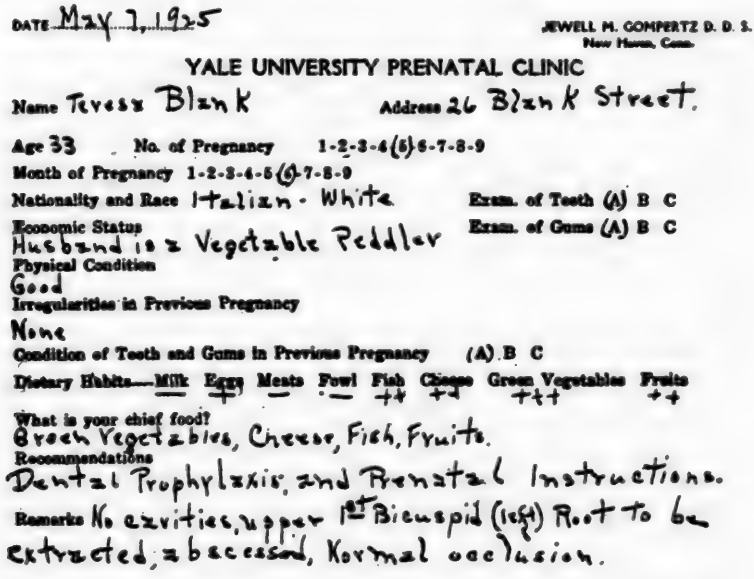
Though it has long been known that there is a tendency for the teeth of pregnant women to decay, the factors causing the decay have never been thoroughly understood; in fact they have not yet been adequately investigated. The newer knowledge of nutrition has shown that dietary factors scarcely recognized a few years ago may exert a profound modifying effect upon the development and texture of the teeth. The nutrient demands of the growing fœtus place a special "drain" upon the reserves of the maternal organism. Furthermore, during the period of gestation, the food habits of the pregnant mother are frequently modified for a variety of reasons. The question accordingly arises as to the extent to which irregularities of the diet may be held responsible for dental disturbances, or what beneficial effects a correct diet may exert. As a corollary to this problem it may be noted that the dentist is frequently confronted with uncertainty as to the extent to which dental work is either indicated or justified during this period.

The Prenatal Clinic of the School of Medicine, Yale University, has furnished an opportunity to investigate in detail some of the abnormal mouth conditions of pregnancy, their possible causes, and prophylactic measures with regard to them. The writer has begun the collection of statistics that may ultimately throw some light upon the question at issue.

Each patient reported at the Prenatal Clinic has given information that has been tabulated upon specially designed record cards. The classification of the patients with respect to the condition of their teeth and gums has been aided by the use of a color scheme: white

[1] Read at a meeting of the Section on Preventive Dentistry, First District Dental Society of the State of New York, New York Academy of Medicine, January 13, 1926.

card, class A, orange card, class B, yellow card, class C. The printed items are the same on each type of card. The specimen card shown in *fig. 1* is self-explanatory. The date, the full name of the individual, the address, age, number and the month of pregnancy, nationality and race are important from a statistical standpoint. The economic status is essentially what one would expect to find in the usual dispensary group.


DATE May 7, 1925

JEWELL M. GOMPERTZ D. D. S.
New Haven, Conn.

YALE UNIVERSITY PRENATAL CLINIC

Name Teress Blank Address 26 Blank Street.

Age 33 No. of Pregnancy 1-2-3-4-(5)-6-7-8-9

Month of Pregnancy 1-2-3-4-5-(6)-7-8-9

Nationality and Race Italian - White Exam. of Teeth (A) B C

Economic Status Exam. of Gums (A) B C
Husband is a Vegetable Peddler

Physical Condition
Good

Irregularities in Previous Pregnancy
None

Condition of Teeth and Gums in Previous Pregnancy (A) B C

Dietary Habits—Milk — Eggs + Meats — Fowl — Fish ++ Cheese ++ Green Vegetables +++ Fruits ++

What is your chief food?
Green Vegetables, Cheese, Fish, Fruits.

Recommendations
Dental Prophylaxis and Prenatal Instructions.

Remarks No cavities, upper 1st Bicuspid (left) Root to be extracted, abscessed, Normal occlusion.

FIG. 1. Record card: Prenatal Dental Clinic, School of Medicine, Yale University

Physical condition is determined by observations from a nutritional standpoint. Irregularities in previous pregnancy include miscarriage, instrumental deliveries, various toxemias of pregnancy, pernicious vomiting, and eclampsia. The references to teeth and gums in previous pregnancies are derived from the patient's story. With respect to dietary habits inquiry brings out whether the patient eats a well balanced diet or an abnormal amount of certain foods. Under recommendations are included: precautions to be followed out by the patient during this period, x-ray, prophylactic treatment and necessary extractions, and dental operations required.

In this way I have already followed during pregnancy approximately 200 patients, including a few from my private practice who are definitely of higher economic and social status.

From this series we may draw the following conclusions: (1) Age, number of pregnancies, and economic status exercise little or no influence on the condition of the teeth and gums. (2) General nutrition and dietary habits seem to make a difference in the mouth conditions. Women who are noticeably undernourished have more decay and periodontal pathology. (3) As a group the foreign born women come to us with better teeth than the American born. At our clinic the greater portion of the foreign born come from Southern and Eastern Europe (Italy, Balkan States, and Russia), and their economic status is certainly no better than that of the American born, but their diet, includes less meat, and more green vegetables. However, we cannot assume that their mouth conditions are due solely to difference in diet, as this may be a racial characteristic.

Besides merely investigating causes, we have tried to prevent or remedy the mouth troubles of pregnancy. As early as possible, we take radiograms of the whole mouth. Necessary extractions are next carried out. Prophylactic treatment is given, and an educational program as to the importance of cleanliness of the mouth is instituted. If this procedure is followed from the beginning of pregnancy there should be no need of extensive dental work. Even if the patient is not seen until late in pregnancy, whatever steps are necessary to put the mouth in good condition should be taken. Only very extensive operative procedure is contraindicated, as is any major operation at this period.

As a further step in prenatal care our patients are advised concerning their diet. There is probably no time when dietetic advice is more acceptable than during the period of pregnancy. The earlier in that period one can reach the prospective mother the better. Our patients are all advised directly by the dietetian, and the following suggestions are generally given regardless of the stage of pregnancy:

Daily—(1) One quart of milk.
(2) An orange and a salad, if possible.
(3) At least one vegetable (preferably green) beside potatoes.

(4) Meat, fish, or poultry but once a day.
(5) Six to eight glasses of water.
(6) Tea and coffee, one cup each.

The foods must be simply prepared and easy of digestion. The amount of fresh vegetables and fruits advised depends on the financial situation of the patients. They are not urged to eat more than three good meals a day, but it is often easier for them to take some of the milk between meals. Special emphasis is laid on the need for milk and green vegetables in order to supply sufficient calcium. If the patient cannot tolerate a large quantity of milk, or if some metabolic disturbance makes a high fluid or high carbohydrate intake inadvisable, then the calcium may be given as calcium lactate.

While the diet is important primarily as a factor in the normal and healthy outcome of pregnancy, we feel very strongly that it has a direct bearing on the teeth and periodontal tissues. The dentist, who often sees the patients earlier in pregnancy than the obstetrician, can give helpful instructions as to what to eat, as well as education in the proper management of disease conditions in the mouth. He can help to dispel the traditional fear that dental interference during pregnancy is dangerous.

In closing, let me quote Dr. George Vincent, President of the Rockefeller Foundation: "The physician of to-morrow will work with the normal rather than with the pathologic. He will have a greater knowledge of the effects upon the health of diet, exercise, mental attitudes, recreation and family and social life." What Dr. Vincent says of medicine, I believe will be equally true of dentistry, for every enlightened student of dentistry sees that there is to-day a definite trend toward preventive dentistry.

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SUPPLEMENT

I. NOTES FROM THE EXECUTIVE PROCEEDINGS OF THE FIRST DISTRICT DENTAL SOCIETY OF THE STATE OF NEW YORK: 1926

JOHN OPPIE MCCALL, D.D.S., F.A.A.P., F.A.C.D., *Editor*

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A. ANNOUNCEMENT OF THE MORRIS L. CHAIM AND THE BENJAMIN J. LORD PRIZES[1]

Milo Hellman, Leland Barrett, and Alfred Walker, Committee

The First District Dental Society of the State of New York has announced an annual prize of Two hundred and fifty dollars ($250) offered by the Morris L. Chaim Fund, and an annual prize of One hundred and fifty dollars ($150) offered by the Benjamin J. Lord Fund, to be known as the Morris L. Chaim Prize and the Benjamin J. Lord Prize, respectively. At present the chief conditions affecting the annual awards are these:

(1) *Papers.* (A). The Morris L. Chaim Prize is offered for the most acceptable paper, in the field of *science and art* as related to dentistry, that embodies the results of original research not previously published. (B) The Benjamin J. Lord Prize is offered for the most acceptable paper, in the field of *clinical* dentistry having immediate and direct value in its application to practical needs, that embodies the results of original research not previously published. (C) *Manuscripts* must be typewritten; accompanied by all necessary photographs, drawings, diagrams, and tables; and ready for publication.

[1] An annual award, the conditions of which are subject to change from year to year.

(2) *Eligibility.* Membership in good standing in any bonafide dental, medical, or scientific society, or registration as a student in a recognized educational institution, at the time of the submission of the manuscript.

(3) *Date of award.* The prizes will be awarded annually at the regular meeting of the Society in December. Papers must be submitted to the Secretary of the First District Dental Society, on or before November 1.

(4) *Publication.* The First District Dental Society of the State of New York will consider the publication of the successful papers, but publication by the First District Dental Society of the State of New York shall not be binding on either party. Wherever and whenever published, a paper awarded a prize shall be accompanied by the statement: "Awarded the Morris L. Chaim Prize, or the Benjamin J. Lord Prize [or both], by the First District Dental Society of the State of New York," with an indication of the year of the award.

(5) *Decision.* The awards shall be made by the Board of Directors of the First District Dental Society of the State of New York. At the discretion of the Board, the prizes may be divided among papers adjudged to be of equal merit, or both prizes may be awarded to one paper, if in the opinion of the judges it merits them.

B. REPORT OF THE MEMBER OF THE EXECUTIVE COUNCIL OF THE DENTAL SOCIETY OF THE STATE OF NEW YORK

Alfred Walker

The Dental Society of the State of New York consists of nine societies, one from each of the nine judicial districts in the State, and each society has one vote in the Council, regardless of the number of its members. The First District Dental Society has but one vote. The Council transacts the routine business of the State Society, and nominates and elects the officers from year to year. At the recent meeting of the Council (May, 1926) the most important transactions were those indicated below.

The Eighth District presented a resolution requesting the Council to endorse and instruct the delegates to the meeting of the American Dental Association to vote for the Eighth District's candidate for president of the Association. Your member voted against this resolution because it was purely political, and also because he opposes the instruction of delegations on matters of this character.

The President, Dr. R. Ottolengui, proposed a plan for the award of the Albert Stephenson Medal, namely, that hereafter two gold medals be presented each year tothe graduates of the two dental hygiene schools in

the state, in Rochester and at Columbia, who make the best showing during the year. The first award was made to school children. Those who attended the dinner at the recent annual meeting will recall that children competed for these medals in a tooth-brush drill. The award of the Stephenson Medal will be made annually at the meetings of the State Society.

Your representative proposed the appointment of a publicity committee, to promote adequate publicity for our state meetings, in the interest of public education in dental matters.

When the new code of ethics, or amendment to the code of ethics, was presented, your member voted in favor of the adoption of all parts except Section 9, which he opposed.

Your representative moved that $1000 be subscribed by the Dental Society of the State of New York to a fund in support of an educational motion-picture film for public use, to be produced by the New York Tuberculosis and Health Association. The motion was unanimously carried.

A motion to affiliate with the American Arbitration Society was introduced and discussed at some length, but, possibly through misunderstanding, there was strong opposition to it. In view of the fact that the First District Dental Society had already voted in favor of such an affiliation, and rather than see the motion lost, your representative moved to amend the original motion to read: "That the Dental Society of the State of New York endorses the plans and purposes of the Arbitration Society." The amended motion was carried unanimously.

A motion to appoint a committee to consider publication of the proceedings of the Society in the *Journal of Dental Research* was approved.

C. REPORT OF THE REPRESENTATIVES IN THE HOUSE OF DELEGATES OF THE AMERICAN DENTAL ASSOCIATION

Theodor Blum and Martin Dewey

The program of the House of Delegates of the American Dental Association, at the annual meeting in Philadelphia, last August, was evidently outlined by the officers of the American Dental Association prior to the meeting. There seemed to be a determination on the part of the President to prevent the presentation of any resolutions or motions that dealt with new business. The order of business of the House of Delegates of the American Dental Association specifically provides a time for the presentation of new business, but only two matters were introduced and they were practically forced before the House of Delegates against the wishes of the

presiding officer. These were (1) an amendment to the by-laws, making it possible to elect a president to fill the vacancy caused by the death of Dr. Biddle; and (2) a resolution, introduced at the last meeting by Dr. Delabarre by unanimous consent, calling attention to the necessity of filling small cavities in deciduous teeth and first molars.

At the Louisville meeting (1925), several amendments to the constitutional and administrative by-laws were presented, which at that time had the practically unanimous endorsement of the House of Delegates. These amendments had been proposed after consultation with a great many members, and every one present seemed to believe that if adopted they would greatly increase the efficiency of the organization. However, President Foster in his address before the House of Delegates specifically requested that the amendments introduced at Louisville be rejected. One of the most important amendments, which was similar to a by-law of the American Medical Association, provided for a speaker for the meetings of the House of Delegates. For the past four years the business of the House of Delegates has been unsatisfactorily conducted because the presidents of the American Dental Association have had too many duties and were unable to familiarize themselves with the conduct of the business of the House of Delegates. The meeting at Philadelphia was a striking demonstration of the fact that the House of Delegates needs a speaker. Nevertheless, the administration of the American Dental Association created enough sentiment to prevent the passage of the by-laws.

A resolution had been adopted, at Louisville, calling for all commissions and officers to indicate their financial needs to the Board of Trustees sufficiently in advance of the date of the annual meeting so that a budget could be printed and presented to the House of Delegates at one session and be acted upon at a subsequent session. For some reason this resolution was not published among the standing resolutions in the by-laws of the American Dental Association. At the first session this matter was called to the attention of the officers of the American Dental Association. Despite that fact, however, no budget was presented to the House of Delegates until its last session, notwithstanding the fact that the by-laws clearly state that no new business could be introduced at the last session of the House of Delegates except by unanimous consent. The proposed budget was never printed, but it was necessary to pass it as read to enable the American Dental Association to function for another year.

A resolution dealing with the transfer of members of the American Dental Association from one state to another had also been presented at Louisville,

but the officers of the Association did not bring it forward for action by the House of Delegates.

The code of ethics of the Dental Society of the State of New York, as adopted by the Executive Council of the State Society, was referred to the Judicial Council for action. It was the intention of the sponsors of the code of ethics of the Dental Society of the State of New York, as passed in May, 1926, to have the code of ethics made a part of the code of the American Dental Association, inasmuch as the code of ethics of the American Dental Association is the code of ethics of the component societies. That part of the report of the Judicial Council of the American Dental Association, as presented to the House of Delegates, which deals with clinics, post-graduate schools, etc., referring to Section 9 of the code of ethics, reads as follows:

"While it is a fact that there are men in the profession who are ever endeavoring to commercialize, it is also true that our profession has made great progress through some of the past and present clinical courses, schools, or institutions which were and are of the type classed as unprofessional in Section 9. Many of the newer and superior methods or techniques, as well as like inventions and therapeutic agencies, which have materially aided the efficiency of the profession, came from such clinical courses or proprietary schools and institutions; and it is a question your Council raises as to whether the best interests of the profession and the public would be served if all such clinics, courses, and proprietary institutions would be declared unprofessional and those connected therewith declared unethical."

The report of the Judicial Council was referred to a special committee, which agreed with the opinion of the Judicial Council. The House of Delegates adopted the report of the Judicial Council, which virtually nullifies the code of ethics as adopted by the Dental Society of the State of New York, so far as the First District Dental Society is concerned.

The American Dental Association had contributed one dollar per member to the conduct of the Seventh International Dental Congress, but no report was made to the House of Delegates in regard to the expenditure of that money.

It is the belief of your delegates that the transaction of the business of the House of Delegates could be more efficiently conducted, if the officers of the American Dental Association were willing to permit the enactment of certain reforms that have been satisfactory in the conduct of the business of the American Medical Association.

During the last meeting of the House of Delegates, Dr. Henry L. Banzhaf, of Milwaukee, was elected President; Dr. R. H. Volland, of Iowa City, President-elect; and Dr. Otto U. King and Dr. Arthur R. Melendy were re-elected Secretary and Treasurer, respectively. Dr. F. H. Lum, Jr., of New Jersey, was elected to the Board of Trustees to succeed Dr. H. J. Burkhart, of New York.

II. NOTES FROM THE EXECUTIVE PROCEEDINGS OF THE NEW YORK ACADEMY OF DENTISTRY: 1925–26

MALCOLM W. CARR, D.D.S., *Editor*

OFFICERS

President—Bissell B. Palmer, Jr.; *Vice-president*—William D. Tracy; *Secretary*—S. E. Davenport, Jr.; *Treasurer*—Alfred L. Kohn; *Editor*—Ralph W. Waddell.

Executive Committee: Leland Barrett, Leuman M. Waugh, Joseph Eby, Chairman.

Fellowship Committee: William B. Dunning, Harold S. Vaughan, Sebert E. Davenport, Chairman.

MEETINGS

During the season of 1925–26, the New York Academy of Dentistry held six monthly meetings, which were preceded by the usual informal dinner, at the Hotel Belmont in New York City.

October. Dr. Thaddeus P. Hyatt, of New York City, read a paper entitled, "Prophylactic Odontotomy; an Operative Procedure for the Prevention of Decay."[2] The paper was illustrated by lantern slides. The discussion was opened by Dr. Charles F. Bödecker, of New York City, and continued by Dr. Harold De Witt Cross, Director of the Forsyth Dental Infirmary for Children, in Boston, Mass.

November. Two closely related papers were read on the general subject of "The Relative Advantages of Amalgam and Gold Inlay for the Restoration of Tooth Structure in Posterior Teeth."[3] Dr. William R. Pond, of Rutland, Vermont, first presented his paper relative to the advantages of amalgam for restoration of tooth structure. This was followed by the presentation of Dr. Henry W. Gillett, of New York City, regarding the advantages of the gold inlay for restoration of tooth structure. Both

[2] Hyatt: *Journal of Dental Research*, vi, p. 389.

[3] Pond and Gillett: *Journal of Dental Research*, vi, p. 427.

papers were illustrated by lantern slides. Dr. Pond opened the debate, by discussing Dr. Gillett's paper, which was followed by Dr. Gillett's discussion of Dr. Pond's paper. Dr. Pond closed the discussion.

January. This meeting was devoted to a symposium entitled, "A Cross Section through Present Day Thought in Dentistry."[4] which was presented by five essayists, as follows: General dentistry, William D. Tracy; orthodontia, J. Lowe Young; periodontia, Arthur H. Merritt; oral surgery, Harold S. Vaughan; prosthodontia, Edward Kennedy.

February. Professor William J. Gies, Columbia University, New York City, delivered an address on "The Findings and Conclusions of the Carnegie Foundation's Study of Dental Education." The discussion was opened by Dr. Holmes C. Jackson, Dean of the New York University Dental School, and was continued by Dr. Frank T. Van Woert, Director of the School of Dentistry, Columbia University, Dr. Leuman M. Waugh, and Dr. William B. Dunning.

March. This meeting was devoted to the presentation of the annual progressive table clinics, on subjects relating to the practice of dentistry. The clinics presented were as follows: Ceramics, William J. Hoag; practical prophylactic odontotomy, Thaddeus P. Hyatt; partial denture technic, Edward Kennedy; periodontal instrumentarium, Arthur H. Merritt; the value of the radiograph in the detection of caries, Edwin J. Nestler; orthodontic principles applying to the general practitioner, Lowrie J. Porter; the tooth brush, Paul R. Stillman; indirect gold inlays, William D. Tracy.

Banquet. A testimonial banquet, under the auspices of the New York Academy of Dentistry, was tendered to Dr. Henry W. Gillett on March fifth, at the Hotel Ambassador, in New York City. Dr. Bissell B. Palmer, Jr., President of the Academy, introduced Dr. William D. Tracy, who as toastmaster presented the following speakers: Dr. LeRoy M. S. Miner, Dean, School of Dentistry, Harvard University, who presented to Dr. Gillett the key of the Phi Sigma Tau Fraternity, to which Dr. Gillett had been elected; Dr. Frank T. Van Woert, Director, School of Dentistry, Columbia University; Dr. Wendell C. Phillips, President, American Medical Association; Dr. Harvey J. Burkhart, Director, Rochester Dental Dispensary; Dr. Sebert E. Davenport, Past-president, First District Dental Society of New York; Dr. Rodriguez Ottolengui, President, Dental Society of the State of New York, who presented to Dr. Gillett, on behalf of his many friends in the profession, a platinum split-second watch; and Mrs.

[4] Tracy, Young, Merritt, Vaughan and Kennedy: *Journal of Dental Research*, vi, p. 197.

Henry W. Gillett. At the conclusion there was a response by Dr. Gillett.

April (*annual meeting*). The following officers were re-elected for the year 1926–27: *President*, Bissell B. Palmer, Jr.; *Vice-president*, William D. Tracy; *Secretary*, S. E. Davenport, Jr.; *Treasurer*, Alfred L. Kohn; *Editor*, Ralph W. Waddell.[5]

Two associate fellows, Dr. Malcolm W. Carr and Dr. Albert J. Irving, were elevated to active fellowship in recognition of achievement in professional activities. Dr. George S. Chappell, better known as Captain Walter E. Traprock, well known traveller and lecturer, entertained the Academy with an illustrated lecture on "The Cruise of the Kawa." The meeting was closed with an appropriate address by Dr. Sebert E. Davenport.

[5] Resigned in October, 1926. Dr. Malcolm W. Carr was appointed to complete the term.

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THE ORIGIN AND EVOLUTION OF THE HUMAN DENTITION

A Palæontological Review

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